ALLEN-BRADLEY
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User's Manual

Bulletin 2750 Intelligent Antenna (DH-485 Multi-Drop)

(Catalog No. 2750-AH, -AHD, -AHP, and -AHPR)

40062-193-01 (A)

Catalog No. 2750-ND001

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Chapter 1 Using This Manual

Chapter Objectives

Read this chapter for an introduction to this manual. This chapter includes:

- Manual Overview
- Intended Audiences
- Related Publications
- Definitions of terms used in this manual

Manual Overview

This manual provides guidelines for using the Allen-Bradley Intelligent Antennas on a DH-485 communications network using the Catalog No. 2760-RB Flexible Interface Module. This information covers the following catalog numbers:

Catalog Nos. 2750-AH, -AHD, -AHP, -AHPR

This manual also provides guidelines for using Radio Frequency Identification (RFID) system components, such as RF (Radio Frequency) tags, RF system host, power supply, and object detect device (optional).

Table 1.A provides an overview of the chapters and appendices in this manual.

Table 1.A
Manual Overview

Chapter	Title	Objectives	Intended Audience
1	Using this Manual	Describes the manual contents, defines the intended audience, defines major terms, and lists related publications.	System Application, Programming, Installation
2	Introduction to RFID	Describes intelligent antennas, RFID system elements, and typical system operation.	System Application, Programming
3	RFID Component Setup Guidelines	Describes guidelines for setting up antenna, tags, and object detect device.	System Application
4	Antenna Installation and Connections	Provides instructions for mounting and connecting the antenna.	Installation
5	Setting Up a Network of Antennas	Provides step-by-step instructions for hooking up a simple DH-485 antenna network. A sample PLC program is provided for obtaining data. For many applications, you can modify this example to fit your own application.	System Application, Programming
6	Antenna Configuration and Operation	Describes how to configure and operate the antenna using Identification Protocol (IDP) Commands.	Programming

Manual Overview
(continued)

Table 1.A
Manual Chapter Overview (Continued)

Chapter	Title	Objectives	Intended Audience
7	IDP (Antenna) Commands	Describes format, content, and application of Identification Protocol (IDP) Commands.	Programming
8	Troubleshooting	Describes troubleshooting indications and guidelines.	System Application, Programming
9	RF Tag Hardware and Installation	Describes the RF tag hardware, and provides mounting and handling guidelines.	Installation, System Application
A	Antenna, RF Tag, and Power Supply Specifications	Environmental and operational specifications for the antennas, power supply, and tags.	System Application, Programming, Installation
B	Additional Requirements for Operation in the United States	Lists FCC licensing requirements for antenna operation, ANSI safety standards, and tag disposal guidelines.	System Application, Programming, Installation
C	DH-485 Communications Protocol	Describes DH-485 communications protocol.	System Application, Programming,
D	ASCII Table	ASCII conversions to hexadecimal equivalents.	Programming

Intended Audience(s)

Each chapter in this manual is written for a specific audience, depending on subject matter. Note in Table 1.A, the intended audience is listed for each chapter under "Intended Audience." The audiences listed in Table 1.A are defined and described below:

- **System Application** – person(s) responsible for the application, installation, and set-up of the RFID system. Suggested prerequisites: (1) Skills and experience in implementing automated equipment and systems, and (2) proficiency in consulting equipment specifications and application information, and applying this information.
- **Installation** – person(s) responsible for mounting and connecting the RFID components. Suggested prerequisites: (1) Proficiency in following written procedures and illustrations, and (2) mechanical and/or electrical skills as appropriate.
- **Programming** – person(s) responsible for RFID system programming, and, if necessary, communications protocol. Suggested prerequisites: (1) Proficiency in programming the selected system host, (2) proficiency in implementing DH-485 communications protocol, and (3) familiarity with both the Flexible Interface Module (Catalog No. 2760-RB) and DH-485 Protocol Cartridge (Catalog No. 2760-SFC2).

Definition of Major Terms

We use the following terms in this manual as defined below:

- **Antenna** – any Allen-Bradley Catalog No. 2750-AH, -AHP, -AHD, and -AHPR Intelligent Antenna.
- **RF tag, or tag** – any of the various Bulletin 2750 RF Tags (radio frequency transponder units).
- **Host** – The RFID DH-485 Network Master Controller.
- **DH-485 (Link Layer)** – Allen-Bradley multi-drop protocol and electrical interface used with RS-485 networks based upon the Flexible Interface Module (Catalog No. 2760-RB).
- **RS-485 (Physical Layer)** – Electrical interface standard for DH-485 communications.
- **IDP (Application Layer)** – Identification Protocol. The application layer of the DH-485 communications protocol.
- **Tag Transaction** – A data read or data write from/to an RF Tag.

Related Publications

Table 1.B lists the Allen-Bradley publications which are related to the operation of the DH-485 antenna. Consult your local Allen-Bradley sales representative for ordering these publications:

Table 1.B
Related Publications

Publication Number	Title	Content Description
2750-2.23	Product Data, Bulletin 2750 Power Supply (Catalog No. 2750-PA)	Specifications, product data, and installation of the 2750-PA power supply.
2750-2.24	Product Data, Configuring a Radio Frequency Identification System	Typical questions and considerations encountered in designing and installing the RFID system.
2750-2.34	Application Information, Calculated RF System Throughput Time	Method for calculating RFID system throughput, including typical data communication times for various PLC family controllers.
2750-2.35	Application Information, Read Distance Specification Change	Lists the updated read distance specification for RF tags.
2750-2.36	Application Information, RFID Tag Programming Procedures	Discusses programming requirements for the programmable RF tags.
2750-2.37	Application Information, RF Tag Capture Window Calculation	Discusses method for calculating the size of the RFID capture window.

Related Publications (Continued)

Table 1.B
Related Publications (Continued)

Publication Number	Title	Content Description
2750-2.9	Product Data, Bulletin 2750 Radio Frequency Tags	Specifications and product data for the various Allen-Bradley RF tags.
2760-812	User Manual,Bulletin 2760 Flexible Interface Module (Catalog No. 2760-RB)	Describes the installation and programming of the 2760-RB module
2760-ND002	User Manual,Bulletin 2760 DH-485 Protocol Cartridge (Catalog No. 2760-SFC2)	Describes programming of the Flexible Interface Module with the DH-485 protocol cartridge.

Warnings and Cautions

Both warnings and cautions may be found in this manual or on the equipment. The following symbols are used:

WARNING: A warning symbol means that you or other people may be injured if the procedures are not followed.

CAUTION: A caution symbol is used when the Antenna or peripheral equipment could be damaged if procedures are not followed.

Chapter 2 Introduction to the RFID System

Chapter Objectives

This chapter describes the 2750-AH series Intelligent Antennas and other system components, and provides an overview of RFID (Radio Frequency Identification) system operations.

Description of the Intelligent Antenna

The Allen-Bradley 2750-AH series Intelligent Antennas transfer information between an RF (Radio Frequency) tag and host(s) on a DH-485 network through the Flexible Interface Module (Catalog No. 2760-RB). The antennas operate as slave devices on the network and respond to commands and requests for data from a computer or PLC® (Programmable Logic Controller) on the network.

The antennas communicate with RF tags through a bi-directional RF link.

There are four models of 2750-AH series antenna. The different models are described below:

Catalog No. 2750-AH Intelligent Antenna – Performs either read or write transactions with read/write tags, or read only transactions with programmable tags. Operating range is up to 4 feet (122 cm) for programmable tags, and up to 2 feet (61 cm) for read/write tags.

Catalog No. 2750-AHD Short Range Antenna – Performs the same transactions as 2750-AH. Antenna signals are transmitted through a remote antenna head to the antenna. Operating range is up to 8 inches (20 cm) for read/write or programmable tags.

Catalog No. 2750-AHP Intelligent Antenna – Performs the same transactions as 2750-AH, and also programs the programmable tags. For programmable tags, the read range is up to 4 feet (122 cm); the programming range is 5-7 inches (13-18 cm). Operating range for read/write tags is up to two feet (61 cm).

Catalog No. 2750-AHPR Remote Programming Antenna – Performs the same transactions as 2750-AHP. Antenna signal is transmitted through a remote antenna head to the antenna. For programmable tags, the read range is up to 5 feet (152 cm); the programming range is 5-9 inches (13-18 cm). Operating range for read/write tags is up to 4 feet (122 cm).

Description of the Intelligent Antenna *(continued)*

Figure 2.1
2750-AH or -AHP Intelligent Antenna

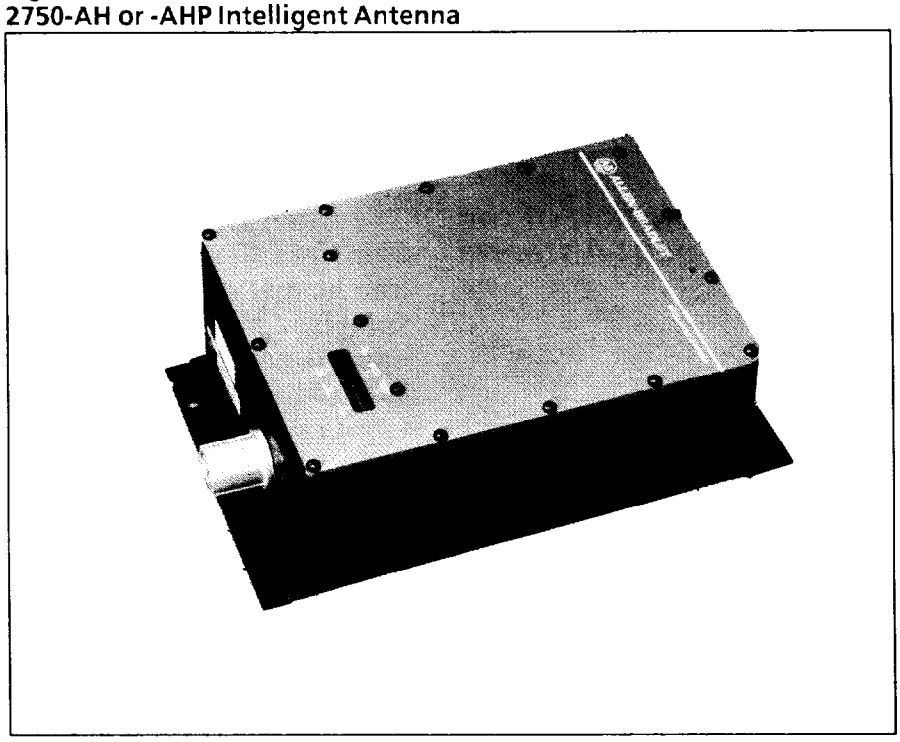

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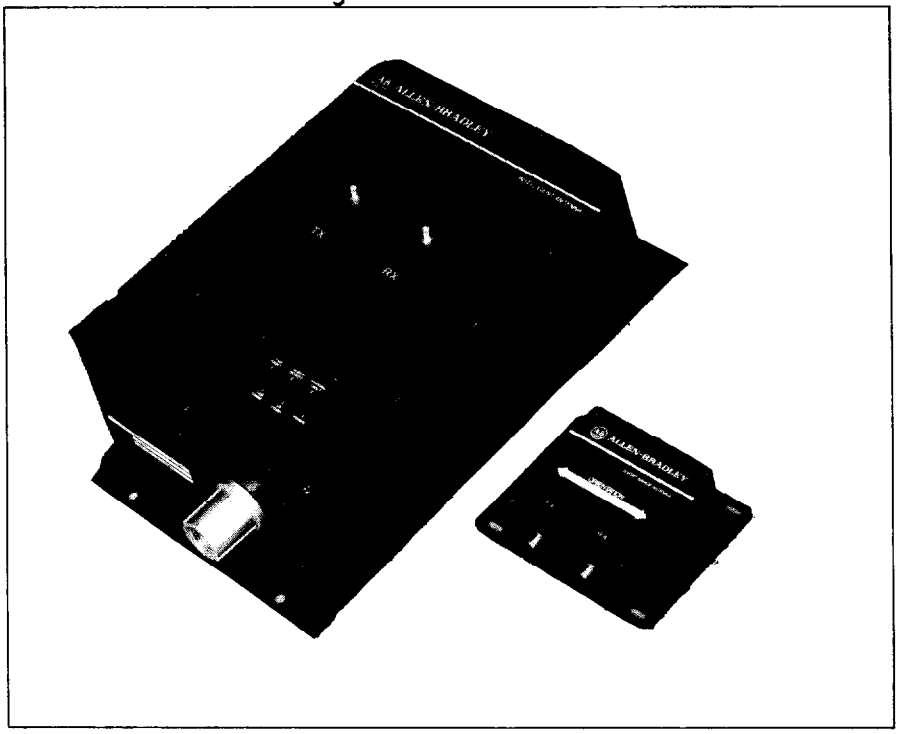
Figure 2.2
2750-AHD or -AHPR Intelligent Antenna



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Antenna Features

The four antenna models all have these features:

- LED panel for diagnostic indications.
- Flanged back plate with mounting holes.
- Removable cover plate with wiring access opening for antenna wiring connections. Cover also allows easy access to the DIP switch used to configure the antenna Baud Rate/Node Number.
- Terminals for connecting DH-485 communication lines, the power supply, and object detect device.

In addition, the 2750-AHD and -AHPR models feature:

- RX and TX connectors on the antenna body for connecting cables to the remote antenna head.
- Remote antenna head with RX and TX connectors.
- Two 10 ft. (3.05 m) coaxial cables for connecting antenna body to remote head (Catalog No. 2750-H1).

Figure 2.1 shows the 2750-AH Intelligent Antenna (the 2750-AHP antenna is identical in appearance).

Figure 2.2 shows the 2750-AHD model with remote head (2750-AHPR is identical in appearance).

Antenna / Network Components

The Allen-Bradley 2750-AH series antenna is one of several components required for a radio frequency identification network (LAN) system. In addition to the DH-485 cabling components you will need (see Figure 2.3):

- RF tags
- Object detect device (optional)
- Power Supply
- Flexible Interface Module (Catalog No. 2760-RB)

Antenna / Network Components (continued)

Figure 2.3 shows the typical components of an antenna.

Figure 2.3
Typical Antenna Components

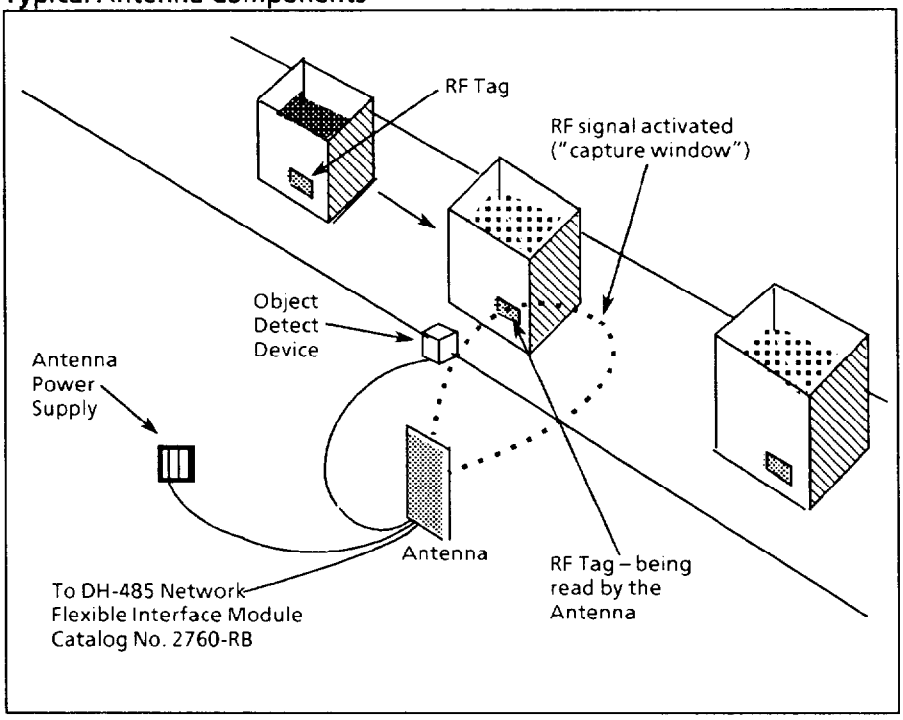
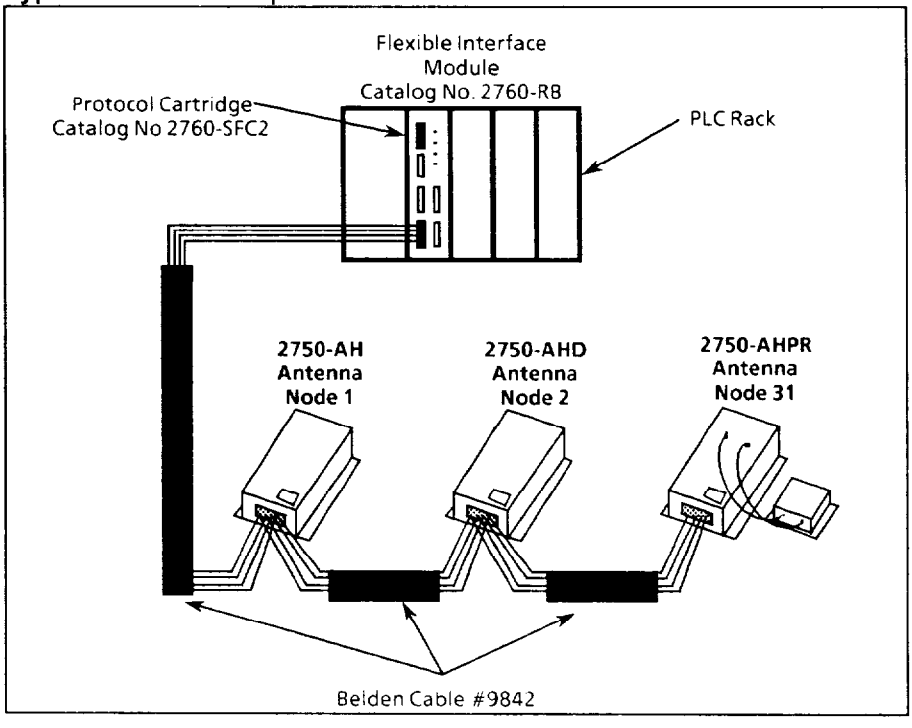


Figure 2.4 shows the components of a typical DH-485 antenna network.

Figure 2.4
Typical Network Components



Description of the DH-485 Network

The DH-485 network uses a token passing protocol to control the access of devices to the network. The network continuously passes small packets of information between master and slave devices on the network. Each network master or smart slave can initiate communications while slaves, such as the Catalog No. 2750-AH, -AHD, -AHP, and -AHPR antennas, can only respond to requests for information.

A DH-485 network based upon the Flexible Interface Module (Catalog No. 2760-RB) has the following features:

- Connection of up to 31 devices.
- Maximum network length of 4,000 feet.
- Multi-master capability
- Token-passing master
- Network options to operate specific Allen-Bradley devices.
- Automatic polling of slaves by Flexible Interface Module.
- Automatic protocol conversions of data.
- Ability to add or remove nodes.
- Cyclical Redundancy Checks (CRC) and retries to ensure integrity of communications.

The DH-485 network may contain the following devices:

- 2750-AH Intelligent Antennas
- 2755-DM6, -DM9 Bar Code Decoders
- SLC-500, 5/01, 5/02 Small Logic Controllers (SLCs)
- Flexible Interface Modules

All devices that operate on the network fall into one of three categories:

- Category 1- Slaves which *do not* accept the token and cannot initiate any communication. Slaves only respond to poll requests from a network master. *The 2750-AH, -AHD, -AHP, and -AHPR antennas are in this category.*
- Category 2- Smart slaves which *do* accept and pass the token. These devices can initiate communication.
- Category 3- Network masters that claim and pass the token and build the logical ring. Only network masters can initiate communications. There must be at least one master on the network.

RF Tags

RF tags are attached to objects for automatic identification and/or information transfer. Each tag has internal memory for data storage. There are two basic types of RF tags as described below:

Read/Write Tags – Up to 2k or 8k bytes of data can be stored in a read/write tag (depending on model). Data can be read from or written to a tag during on-line operations. Tags have byte-addressable, battery-backed RAM memory.

Programmable Tags – Tags can operate as having 6-digit, or 20- or 40-character memory (depending on antenna configuration). Tags have non-volatile, EEPROM memory, and are normally programmed off-line. Data is read from tags during on-line operations.

Flexible Interface Module

The Flexible Interface Module (Catalog No. 2760-RB) is a 2 slot module that allows communications between Allen-Bradley PLCs®, RF Antennas, Bar Code Systems, Machine Vision Products, Message Displays, Programmable Limit Switches, Serial Printers, and other Flexible Interface Modules. An external protocol cartridge plugs into one of two slots on the front of the Flexible Interface Module. The protocol cartridge configures each of the device ports on the Flexible Interface Module (Catalog No. 2760-SFC2 Protocol Cartridge configures the ports for a DH-485 network).

Power Supply

The antenna requires an external 24VAC power supply. We recommend the Catalog No. 2750-PA Power Supply. A single 2750-PA power supply can power up to 3 antennas.

Object Detect Device

The antenna has terminals for connecting the output from an external object detect (presence sensing) device. The object detect contact closure signals the antenna to begin attempting communication with the tag.

Use the object detect to enable the antenna to transmit only when the targeted tag is present. Using the object detect reduces antenna signal on-time, which decreases the chance of signal interference between antennas, or the unintended reading of a non-targeted tag.

Any of a number of devices can be used as the object detect. The antenna can supply the power to certain types of object detect devices. We recommend Allen-Bradley Bulletin 880L object detectors.

Antenna Operation

Operate the antenna by sending appropriate IDP commands to the antenna from the host. The antenna returns a response to each command (except a Reset). The antenna response includes a success/fail code, and any data requested in the command. The antenna commands are used to:

- Configure the antenna for tag type, object detect, transaction timeout, and RF field strength level.
- Return the current settings of the above parameters.
- Reset the antenna.
- Run antenna diagnostics and return diagnostic results.
- Perform tag transactions.

Tag Transactions

There are three types of tag transactions:

- **Read Tag** – The antenna reads data from a tag and transfers the data to the DH-485 network master. This type of transaction is valid for either a read/write tag or programmable tag.
- **Write Tag**– The antenna transmits the data to a tag; the data is stored tag RAM memory. This transaction is valid only for a read/write tag.
- **Program Tag** – The antenna transmits data to a tag; the data is stored in tag's EEPROM. This transaction is valid only for a programmable tag (only with 2750-AHP and -AHPR antennas.

The tag transactions can be performed in the following ways:

- **Using Repeat Count** – to automatically repeat a transaction a specified or an unlimited number of times, or to perform the command once.
- **Using Chained Commands** – to combine multiple transactions in a single command, such as a read tag transaction followed by a write tag transaction.

Tag Transactions (Continued)

- **Using Addressable Tag Memory** – to specify the tag memory locations accessed in read or write transactions.

  Note: For read/write tags, which have 2k or 8k bytes of memory, the amount of data transferred per transaction is limited.

- **Using Object Detect** – to attempt the tag transaction only when the object detect signal goes active.

- **Using a Timeout** – to limit the duration of the transaction. We recommend specifying a timeout limit, based on the requirements of your application.

Interface and Sensor Processors

There are two processors of information within the antenna, the interface processor and sensor processor. The interface processor handles the transfer of data between the antenna and the network master. The sensor processor handles the transfer of data between the antenna and the RF tag. Data is transferred between the processors using bank swapped RAM. When sending commands to the antenna, the commands will be directed to either of these processors. For example, there are two echo commands: Sensor Processor Echo Command and Interface Processor Echo Command. Chapter 6 describes all of the antenna commands and the data (if any) that is returned.

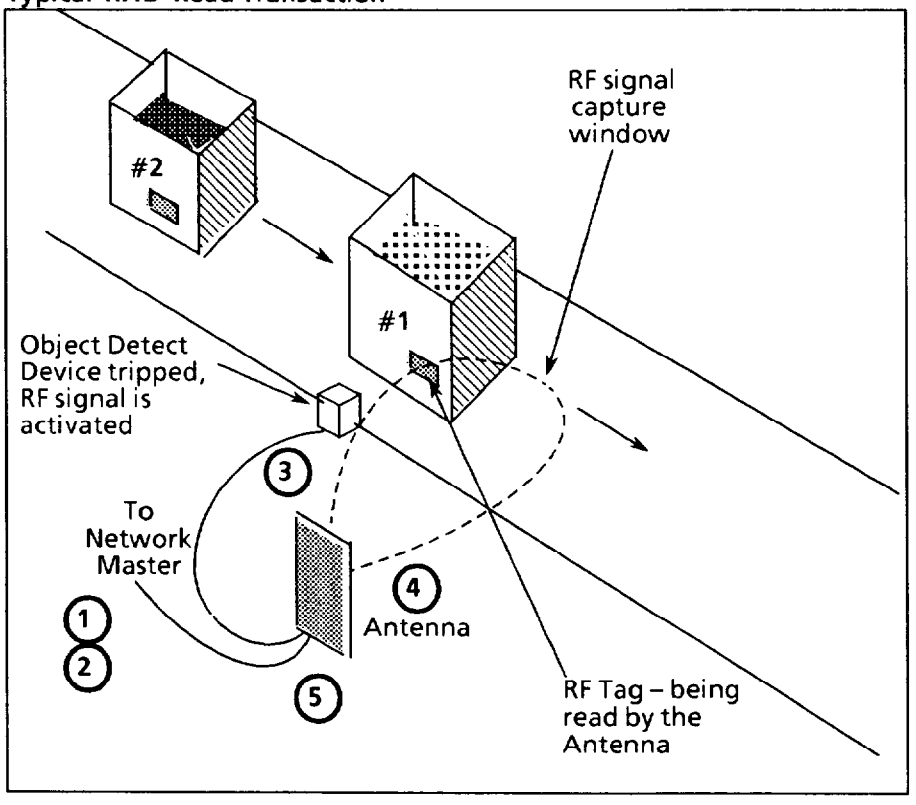
Typical "Read" Application

This section describes a typical read tag transaction. Refer to Figure 2.5:

Programmable tags are mounted on pallets, which move along a conveyor. The tags each contain a 40-character code identifying the pallet.

A photoelectric switch (object detect device) is connected to the antenna. The switch is placed near the edge of the antenna signal operating range (capture window) so RF communication begins when the tag is within range.

Figure 2.5
Typical RFID Read Transaction



Sequence of Operation - The following events occur in the scenario in Figure 2.5 for a read tag transaction:

1. At system startup, the host sends a configuration command to the antenna. This sets the antenna tag type (read only), RF power level (low), object detect input (enabled), and timeout limit for tag communication (3 seconds).

2. The host sends a command to the antenna to read the 40-character code from the tag. The antenna then waits for the object detect to go active.

3. Pallet #1 trips the object detect.

Typical "Read" Application (continued)

4. The object detect active signal enables the antenna to start transmitting, reading the tag. The RF tag on pallet #1 moves into the antenna's RF signal (called the "capture window").* The antenna attempts to read the tag until successful, or until the 3-second timeout expires.

*Note: The capture window is described in Chapter 3.

5. Upon a successful tag read, the antenna returns a response to the host, which includes the 40-character code from the tag.

   If the read fails, the antenna returns a response with a code indicating the type of failure.

Steps 2-5 are repeated for pallet #2, and for as long as the system is running.

Note: Instead of having the host resend a command repeatedly (Step 2), you can send the command once and, using the repeat count, indicate a specific number of repeats, or a repeat forever. This is useful when you intend to read the same number of bytes from the same tag memory locations.

RFID Site Evaluation

Because of the nature of the RF signal, certain physical site factors may require adjustment in order to enhance the reliability of your RFID system operation.

For your convenience, you can contract Allen-Bradley Support Division to conduct a site evaluation. The site evaluation will determine what site accommodations are required.

General guidelines for component set-up can be found in Chapter 3, "RFID Component Setup Guidelines." Also refer to RF Implementation Plan (Publication 2750-2.24 May 1991).

Chapter 3 RFID Component Setup Guidelines

Chapter Objectives

This chapter presents guidelines to apply when installing RFID components – antenna, RF tags, and object detect device. Read both this chapter and Chapter 4 **before physically installing the antenna, RF tags, and object detect device.**

Note: Some of the procedures in this chapter require that you use the Allen-Bradley Field Strength Meter (Catalog No. 2750-DS).

Component Set-up Overview

In order to enhance the reliability of tag communications, you must set up the RFID system components so that the targeted RF tag, and only the targeted tag, is within the capture window when the tag transaction is attempted.

To accomplish this, you need to complete the steps listed below, which are described in following sections:

- Determine the component spacing for the intended RFID operation (i.e., antenna-to-tag spacing and tag-to-tag spacing).
- Set the RF field strength level of the antenna signal, and determine the limits of the signal capture window (use of the Field Strength Meter is required).
- Correctly orient the tags to the antenna.
- Position the object detect device (if used).

Note: The dimensions and ranges discussed in this chapter are offered as general guidelines only. Actual setup dimensions may differ, depending on site specific factors.

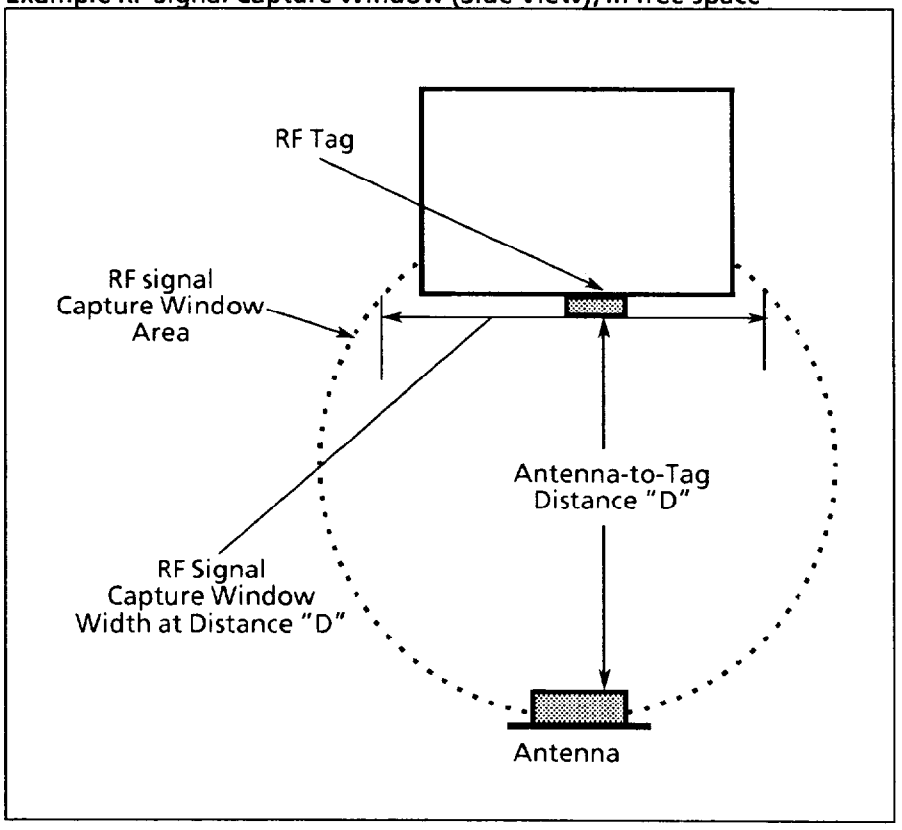
Capture Window

The **capture window** is the area within the antenna's RF field where the field strength is adequate for consistent tag communications (see Figure 3.1). This operating range varies, depending on the antenna type, tag type, the RF level setting, and the type of operation (see Table 3.A).

The antenna can also communicate with a tag outside this range, but communication is less reliable. Because of this, certain minimum spacing requirements must be maintained (see "Antenna-to-Tag Spacing" and "Tag-to-Tag Spacing").

Capture Window
(continued)

Figure 3.1
Example RF Signal Capture Window (Side View), in free space



Antenna-to-Tag Spacing

Antenna-to-tag spacing is the perpendicular distance from the antenna face to a tag positioned directly in front of the antenna for a transaction (see Figure 3.1). Table 3.A lists the nominal operating ranges (under "Antenna-to-tag Spacing") for the different antennas, tag types, and type of operation.

Antenna-to-tag spacing influences the tag-to-tag spacing requirement (see "Tag-to-tag Spacing"). Generally, the greater the antenna-to-tag distance, the higher the required antenna RF power level; at higher power levels, more tag-to-tag spacing is required to isolate the non-targeted tags from the RF signal.

Antenna-to-Tag Spacing
(continued)

Table 3.A
Antenna-to-Tag Spacing Ranges

Tag Type	Transaction	Antenna Type	RF Level Settings	Antenna-to-Tag Spacing
Read/Write①	Read or Write	2750-AH, -AHP	5 levels	6 to 24 inches (15.2 to 61 cm)
		2750-AHPR	5 levels	6 to 48 inches (15.2 to 122 cm)
		2750-AHD	2 levels	2 to 8 inches (5.1 to 20 cm)
Programmable ①	Read	2750-AH, -AHP	5 levels	6 to 48 inches (15.2 to 122 cm)
		2750-AHPR	5 levels	6 to 60 inches (15.2 to 152 cm)
		2750-AHD	2 levels	2 to 8 inches (5.1 to 20 cm)
	Program	2750-AHP	1 level②	5 to 7 inches (12.7 to 17.8 cm)
		2750-AHPR	1 level②	5 to 9 inches (12.7 to 23 cm)

① See Pub. No. 2750-2.9, Product Data, "Bulletin 2750 RF Tags," for more information relating to tag operating characteristics.
② When programming programmable tags, the antenna transmits at a fixed power level.

Tag-to-Tag Spacing

Minimum spacing is required between the RF tags at the point where tags cross the antenna signal for transactions, in order to prevent reading from or writing to a non-targeted tag. This also helps prevent unnecessary drain on the tag's battery when using read/write tags.

This section assumes your tag-to-tag spacing is adjustable. If your tag-to-tag spacing is fixed, you may have to adjust the the antenna-to-tag spacing to accomplish the required isolation.

Note: If you require tighter tag-to-tag spacing than suggested in this section, call your Allen-Bradley representative for assistance.

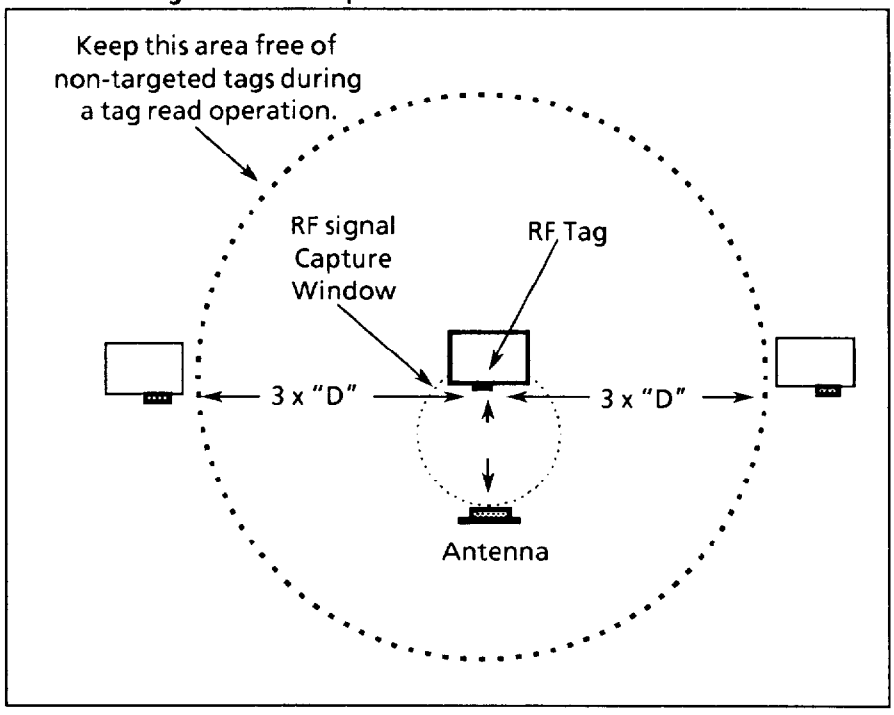
Programmable Tag Spacing

Read Operations – In general, tag-to-tag spacing should be at least three times the antenna-to-tag spacing (see Figure 3.2) to isolate non-targeted tags from the RF signal.*

Example Spacing Calculation – Assume the antenna-to-tag spacing is 20 inches (51 cm). Then the minimum tag-to-tag spacing would be (3 × 20) inches, or 60 inches (152 cm).

Programming Operations – Set tag-to-tag spacing according to the distances as shown in Figure 3.3 where the distance "X" = 20 feet (61 m). For distances less than this, contact your Allen-Bradley representative.

Figure 3.2
Isolation Ranges for Read Operations



Read / Write Tag Spacing

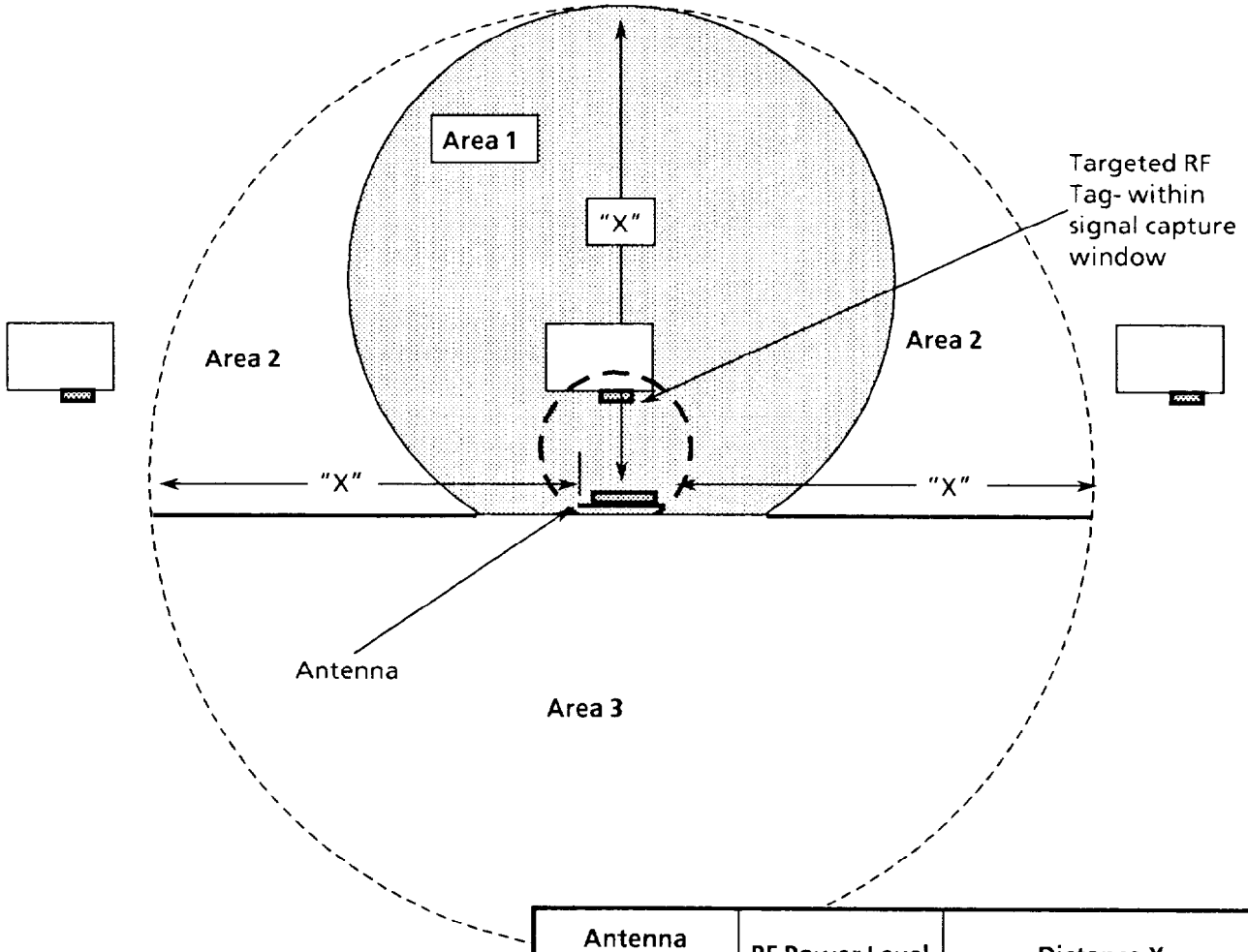
Read Operations – In general, the tag-to-tag spacing should be at least three times the antenna-to-tag spacing (see Figure 3.2) to isolate non-targeted tags from the RF signal.*

Write Operations – Set tag-to-tag spacing according to the distances as shown in Figure 3.3. The distance "X" depends on the power level setting.

***Note:** For Catalog No. 2750-AHD antennas, tag-to-tag spacing minimums are 38 inches (96.5 cm) for high power settings, 32 inches (81.3 cm) for low power settings.

Read / Write Tag Spacing
(continued)

Figure 3.3
Isolation Ranges for Write or Program Operations



Area 1- Minimum recommended spacing. No tags other than targeted tag in this range during transmission.

Area 2- Preferred spacing range for additional tag isolation. No tags other than targeted tag in this range during transmission.

Area 3- Preferred spacing range behind the antenna (tags in this area may be subject to reflected signals).

Antenna Catalog Nos.	RF Power Level	Distance X
2750-AH and 2750-AHP	5	15 ft. (4.6 m)
	4	12 ft. (3.7 m)
	3	9 ft. (2.7 m)
	2	6 ft. (1.8 m)
	1	3 ft. (0.9 m)
	Idle①	6 in. (15 cm)
2750-AHPR	5	32 ft. (9.8 m)
	4	23 ft. (7.0 m)
	3	18 ft. (5.5 m)
	2	12 ft. (3.7 m)
	1	8 ft. (2.4 m)
	Idle①	8 in. (20 c m)
2750-AHD	Low or High	4 ft. (1.2 m)
	Idle①	2 in. (5 cm)

① Idle: Weak signal emitted when antenna is powered up, but not attempting to transmit.

Positioning the Antenna

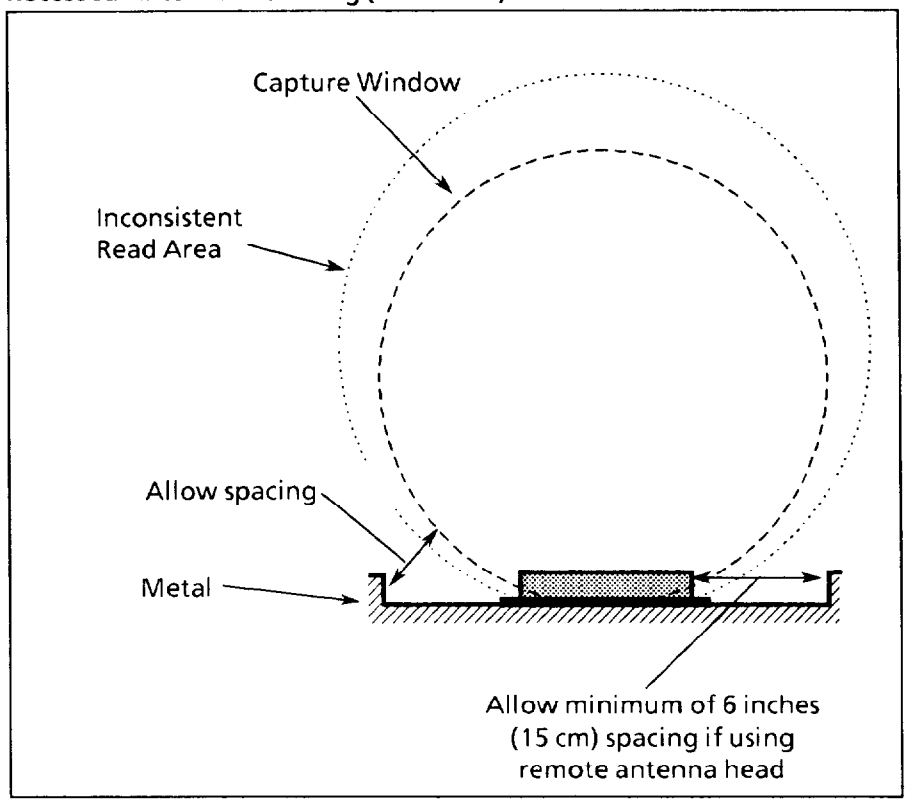
When positioning and mounting your antenna, follow the guidelines provided in this section.

Recessed Mounting

If you plan to mount the antenna within a recessed metal cavity, call your Allen-Bradley representative for application-specific guidelines. General guidelines are:

- Allow spacing between the capture window boundaries and the metal walls (refer to Figure 3.4).
- For remote antenna heads (Catalog No. 2750-H1), allow a 6-inch minimum spacing between metal surface and sides of antenna.
- Position the antenna at the top of the recess.

Figure 3.4
Recessed Antenna Mounting (Side View)


Capture Window
Inconsistent Read Area
Allow spacing
Metal
Allow minimum of 6 inches (15 cm) spacing if using remote antenna head

Effects of Metallic Surfaces

Surrounding metallic surfaces (which cause reflections) may create signal peaks and nulls in your capture window. Nulls can inhibit tag transactions.

Minimizing the Effect of Metallic Surfaces

If possible, keep the areas between and to the sides of the antennas and tags free of metallic surfaces (see Table 3.B for metallic surface distances for stationary transactions).

Table 3.B
Minimum Spacing from Antennas to Nearby Metallic Surfaces

Distance Between Tag and Antenna	Minimum Distance Between Tag and Reflective Surface
Up to 3 inches (76mm)	10 inches (254mm)
Over 3 inches (76mm)	Three times (3 X) the tag to antenna distance

If you can not follow the spacing recommended in Table 3.B, minimize the effect of surrounding metal as follows:

- Set up the RF operation so tags are moving through the capture window during antenna communication. This allows the tags to move through any nulls.
- For stationary transactions, locate a position where the RF signal level is adequate for your tag type. To do this, use the Allen-Bradley 2750-DS Field Strength Meter (see page 3-8).

The locations of peaks and nulls should not change, as long as the locations of surrounding metallic surfaces do not change. If locations of metal surfaces are changed, you may have to adjust the stop location.

Note: You cannot have any metal objects located directly between the antenna and tag.

Before permanently positioning the antenna and/or tags, use the Allen-Bradley 2750-DS Field Strength Meter to check the RF field strength throughout the area intended for tag operations (see page 3-8).

Although we recommend using the Field Strength Meter, the following formulas can be used to determine possible locations of peaks and nulls (refer to Figure 3.5):

Minimizing the Effects of Metal Surfaces (continued)

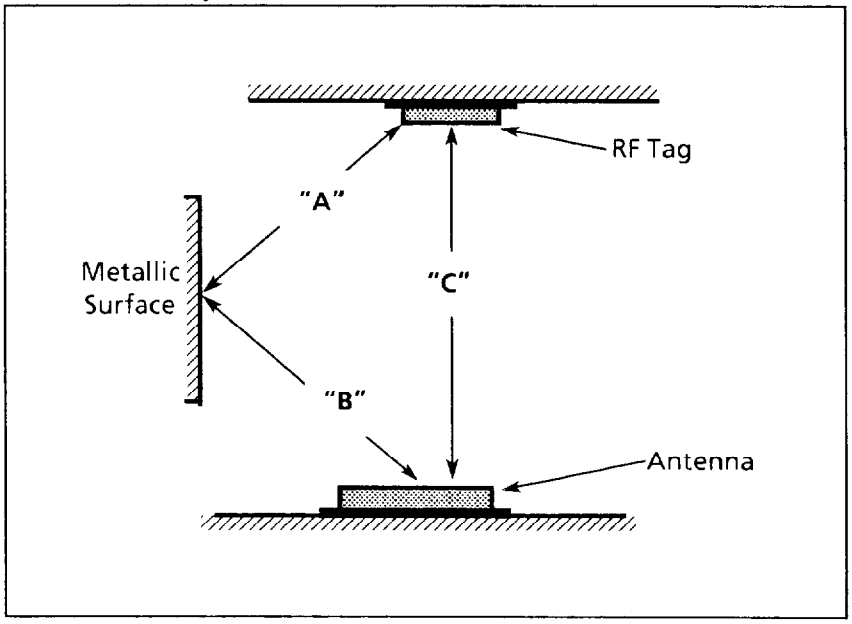
Peak – Signal enhancement (this can cause tag reads outside the capture window) at these distances:

$(A + B) - C = (n)\,\lambda, \pm 15\%$
where n is a whole number, $\lambda = 13$ inches (33 cm).

Null – Signal cancellation can occur at these distances:

$(A + B) - C = (n/2)\,\lambda, \pm 15\%$
where n is an odd whole number, $\lambda = 13$ inches (33 cm).

Figure 3.5
Effects of Nearby Metallic surfaces



Defining the Capture Window Boundaries

We recommend you measure the antenna field strength to define the capture window boundaries and determine the area of operation. After positioning the antenna for your application, set and adjust the antenna field strength level, using the Allen-Bradley Field Strength Meter, Cat. No. 2750-DS. The required field strength level depends on the tag type.* See the "Field Strength Meter Instruction Sheet" (Part No. 40062-108-01) for instructions.

*Note: Tag sensitivity decreases if tags are not mounted on a metal backplane (except for Flatpak-type tags, which are designed for mounting on non-metallic surfaces). See Chapter 9 for guidelines and recommendations on installing the different RF tags.

Tag-to-Antenna Orientation

When the antenna attempts to communicate with a tag, the tag must be properly oriented to the antenna, or communication may be hindered or prevented.

For orienting RF tags to the Catalog No. 2750-AH, or -AHP antennas (see Figure 3.6):

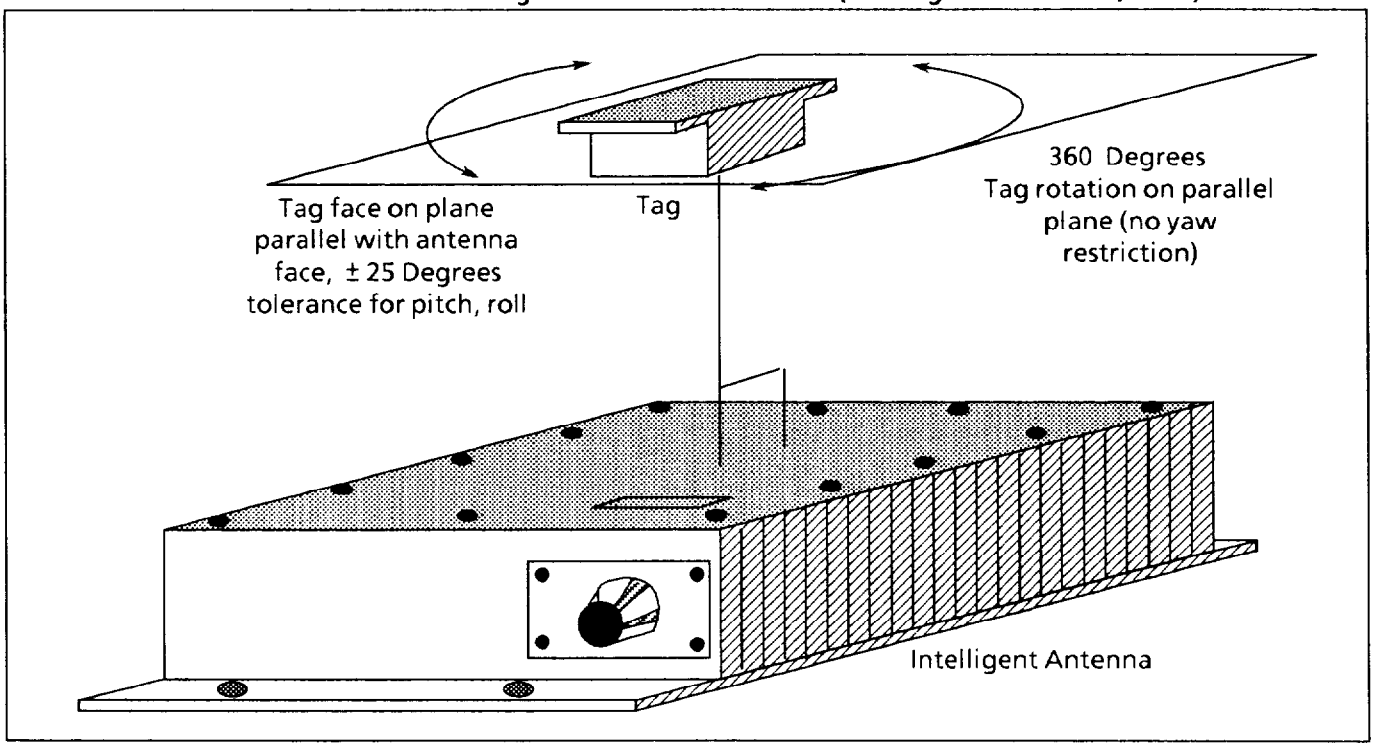
- The face of the tag must be on a plane parallel to the plane of the antenna face, with a tolerance of ±25° pitch or roll off plane (see Figure 3.7 for pitch, roll examples).
- The tag may be rotated 360° about its center axis.

When orienting RF tags to the remote antenna head of Catalog No. 2750-AHD, or -AHPR antennas, more stringent guidelines apply (see Figure 3.7):

- Antenna remote head and tags are marked with an orientation line. Line up the orientation lines of tags to that of the antenna (±25° yaw).
- The face of the tag must be on a plane parallel to the plane of the antenna face, with a tolerance of ±25° for pitch or roll.

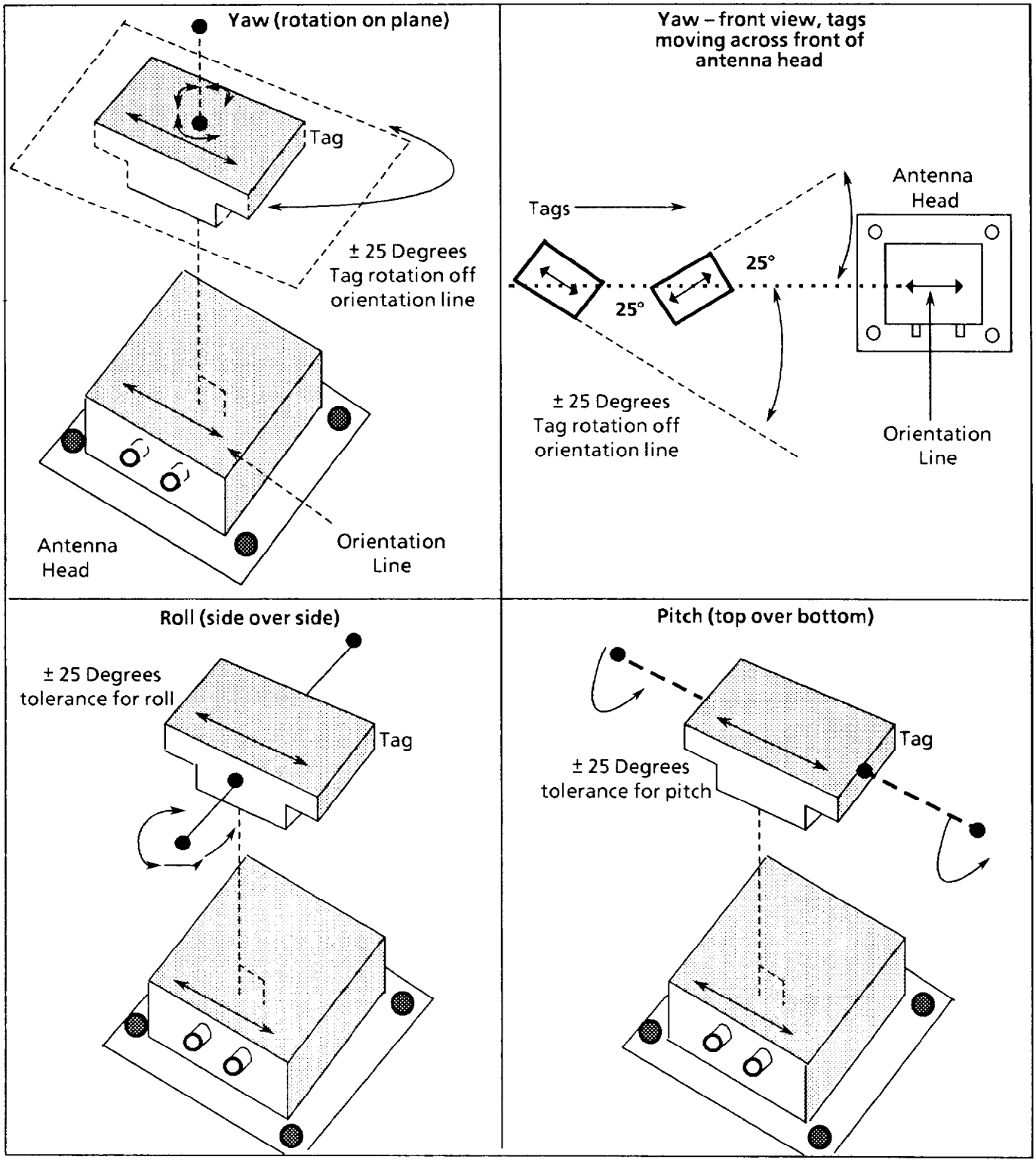
Note: Tag may be off plane in one axis only.

Figure 3.6
Tag-to-Antenna Orientation (Catalog Nos. 2750-AH, -AHP)


Tag face on plane parallel with antenna face, ± 25 Degrees tolerance for pitch, roll
Tag
360 Degrees Tag rotation on parallel plane (no yaw restriction)
Intelligent Antenna

Tag-to-Antenna Orientation *(continued)*

Figure 3.7
Tag-To-Antenna Orientation (Catalog Nos. 2750 -AHD and - AHPR)



Moving Tag Speed Limitations

If RF tag transactions occur while the tag is moving, tag speed limitations apply. For maximum tag speeds for each tag type, refer to the specifications listed in Appendix A.

Note: The tag speeds listed are given for the maximum antenna-to-tag distance of each tag. If you decrease tag-to-antenna distance, the capture window width and maximum tag speed decreases proportionally.

Testing Tag Transactions

As a final test, after connecting and positioning the antenna, try to execute antenna transactions with RF tags. To do this, place tags within the antenna capture window where they would normally travel during system operation, and send a command to the antenna.

If tag transactions are not successful, check the return code in the antenna response for type of failure. You may have to reposition tags, reposition the antenna, reset the RF level, or make other adjustments.

For more troubleshooting information, see Chapter 8.

Positioning the Object Detect Device

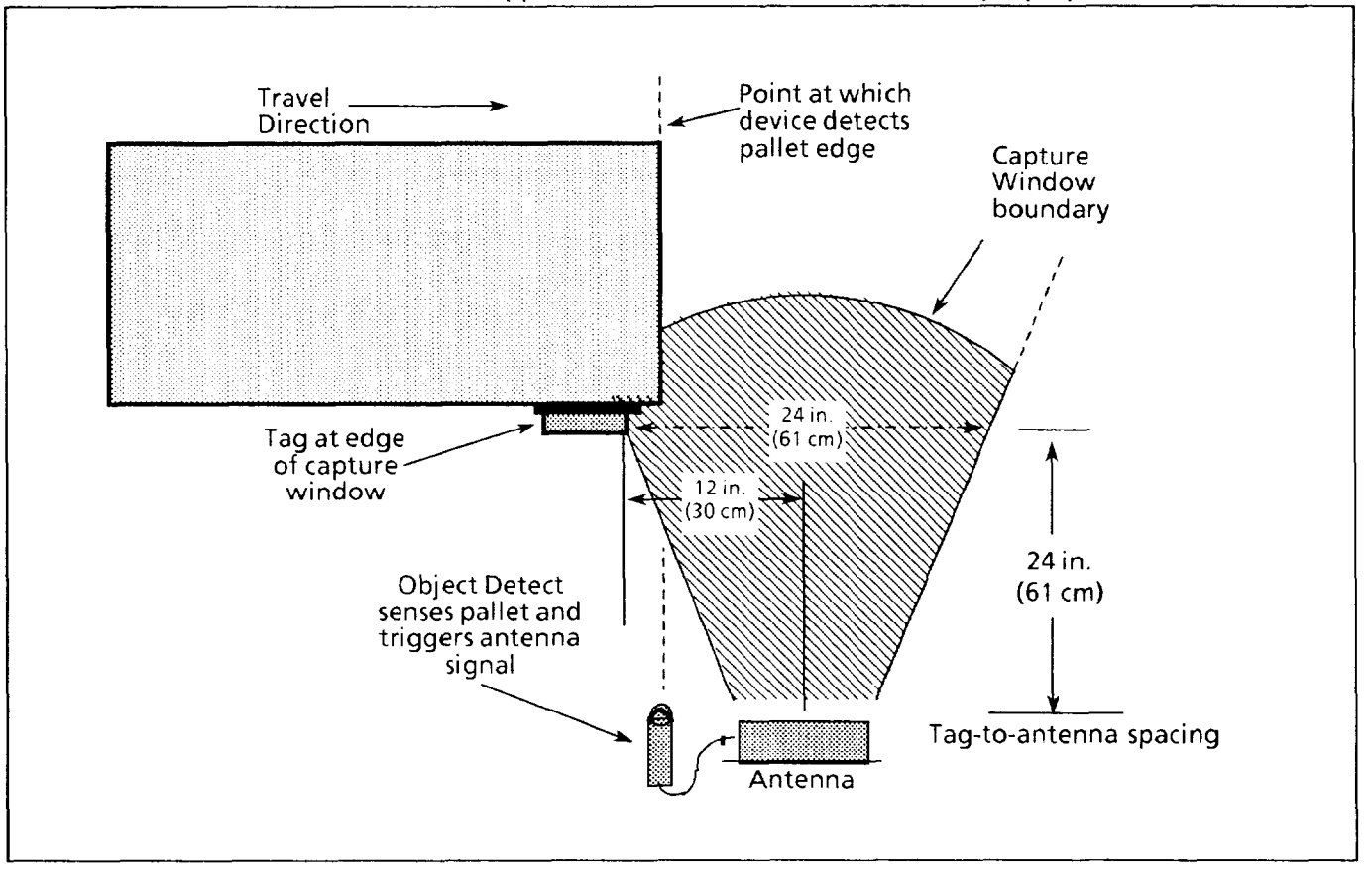
The object detect device detects the presence of the object to which a tag is attached.

Correct positioning of the object detect depends on the application, including whether the tag is moving during transactions, and where the tag is located relative to the detectable edge of the object to which the tag is attached.

Note: Never place the object detect device in the direct path of the signal between the tag and the antenna. Keep the device outside the capture window boundaries if possible.

Positioning the Object Detect Device *(continued)*

Figure 3.8
Example Object Detect Placement
(approximate dimensions used, for example purposes)


Travel Direction
Point at which device detects pallet edge
Capture Window boundary
Tag at edge of capture window
24 in. (61 cm)
12 in. (30 cm)
24 in. (61 cm)
Object Detect senses pallet and triggers antenna signal
Tag-to-antenna spacing
Antenna

Moving Transactions

For moving tag transactions, position the object detect device so that it triggers when the tag crosses the leading edge of the capture window. As a guideline, the capture window width can be estimated as roughly equal to the antenna-to-tag spacing, as shown in Figure 3.8.

Example Positioning – Refer to Figure 3.8. The object detect is placed so the leading edge of the pallet trips the object detect just when the RF tag enters the capture window. The antenna transmission begins at that moment. This allows the tag to remain in the window for the maximum amount of time.

Stationary Transactions

For stationary transactions, place the object device so the device goes active when the tag is at its stop location.

Note: The antenna emits a weak "idle" signal when powered up and not transmitting. This signal can turn on a read/write tag, and cause battery drain. Do not stop a read/write tag within idle range of the antenna for long durations – see the "Idle" dimensions in the table in Figure 3.3.

Chapter 4 Antenna Installation and Connections

Chapter Objectives

This chapter explains how to connect the Allen-Bradley 2750-AH series Intelligent Antenna, including how to:

- Remove and replace wiring access cover plate.
- Configure and connect Allen-Bradley 2750-PA power supply to the antenna, and check antenna power up.
- Connect the network master to the antenna, set the baud rate and node number.
- Connect the object detect device (optional) to the antenna.
- Connect the remote antenna head to the antenna (used with 2750-AHD and -AHPR models antennas).
- Network Termination
- Shield Termination

Before Installing the Antenna

Have the following information on hand in order to connect the antenna to the other RFID components:

- Desired antenna mounting location (and remote head, if applicable), and orientation.
- Wiring distances from the antenna to the communications interface module or host. Wiring distance to the power supply and to the object detect device.
- Network Baud Rate and Node Number.
- Network Termination.

Required Hardware and Equipment

This section lists the hardware required for installing and connecting the 2750-AH, -AHP, -AHD, -AHPR antennas:

- Cables – Two 10-foot (3.05 m) coaxial cables (Cat. No. 2750-C1) for connecting remote head (Cat. No. 2750-H1).
- Power Supply – Allen-Bradley 2750-PA Power Supply.
- Shielded, twisted pair cabling (BELDEN #9842 or equivalent) from host or communications interface module port.
- Node Connector (Catalog No. 2760-A485). Used to connect network to Flexible Interface Module.
- Object detector (optional presence sensing device).

Wiring Cover Plate Removal

Remove the retaining screws at the four corners of the cover plate and remove cover plate (see Figure 4.1).

CAUTION: When removing or handling the cover plate, be careful not to remove, damage, or lose the "O" ring surrounding the wiring access window.

After removing the cover plate, you will see the connectors and jumper pins you need to access when installing and connecting the antenna (see Figure 4.2).

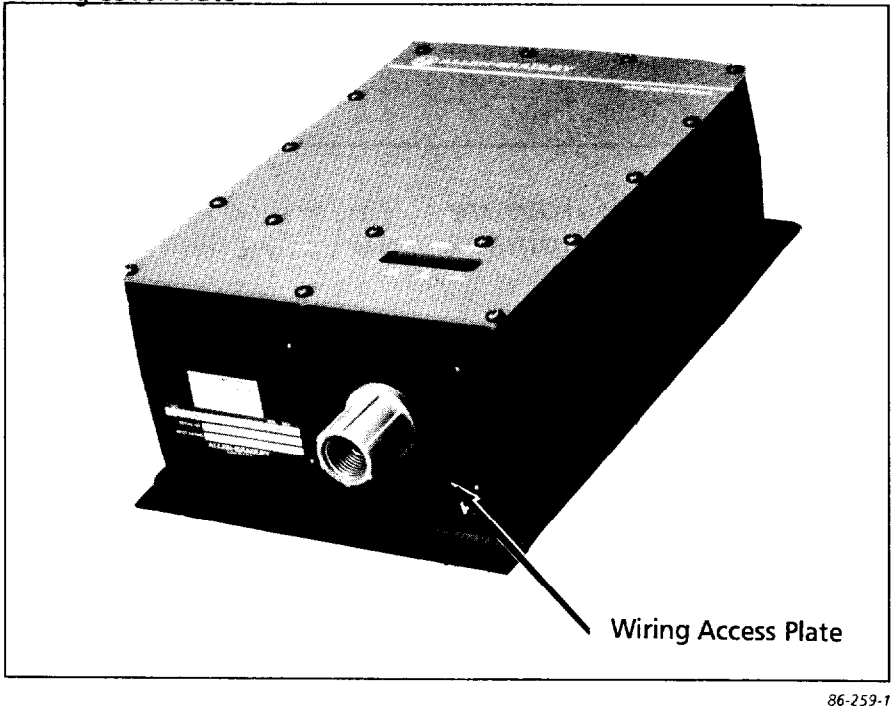
Note: Be sure to thread wires through the opening in the wiring cover plate before connecting to the antenna.

When reinstalling the cover plate:

1. Make sure the "O" ring is in place.
2. Install and tighten the retaining screws at the four corners of the cover plate. Torque to 14 inch-pounds.

Note: The wiring access opening is designed for use with a conduit fitting. If you are not using conduit, be sure to seal or plug the opening after installing the wiring to prevent debris from entering.

Figure 4.1
Wiring Cover Plate



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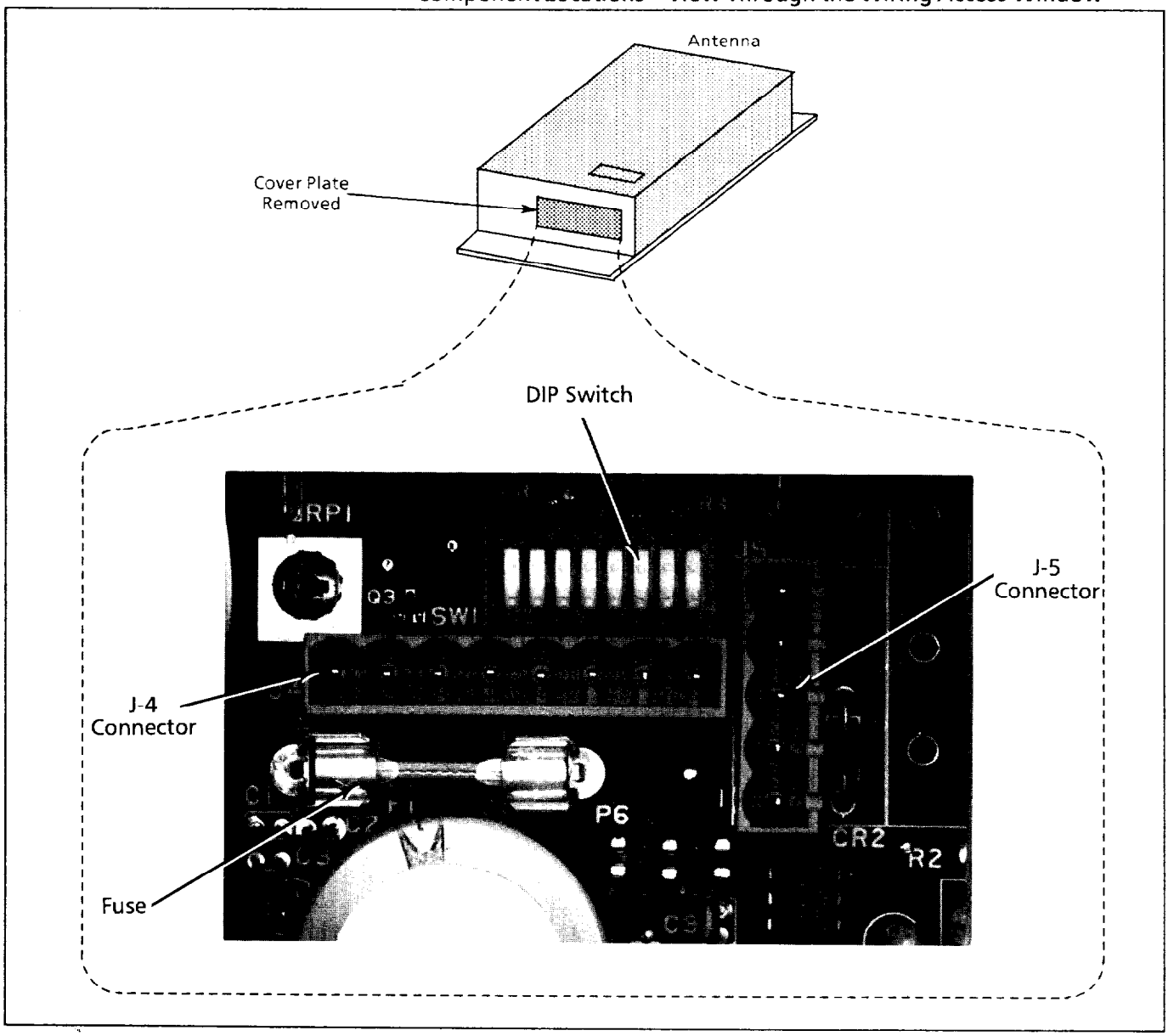
Wiring Cover Plate Removal
(continued)

Figure 4.2
Component Locations – View Through the Wiring Access Window



91-011

Connecting Power to the Antenna

The antenna requires a 24VAC power source (see Appendix A for antenna electrical specifications). The Allen-Bradley Bulletin 2750-PA Power Supply meets the antenna power specifications. Refer to Publication No. 2750-2.23, "Product Data, Bulletin 2750 Power Supply," for mounting dimensions.

Power Supply Configuration

Configure the 2750-PA Power Supply terminals H1, H2, H3, and H4 according to the input line voltage (see Figure 4.3). Use #14 gage electrical wire.

WARNING: Do not attempt to connect live power wires to the antenna or power supply. Make sure no power is connected to the power supply when wiring the power supply or connecting power supply to antenna. Crossing of live wires or touching a live terminal can result in personal harm, and/or damage to equipment.

Power Supply Connection

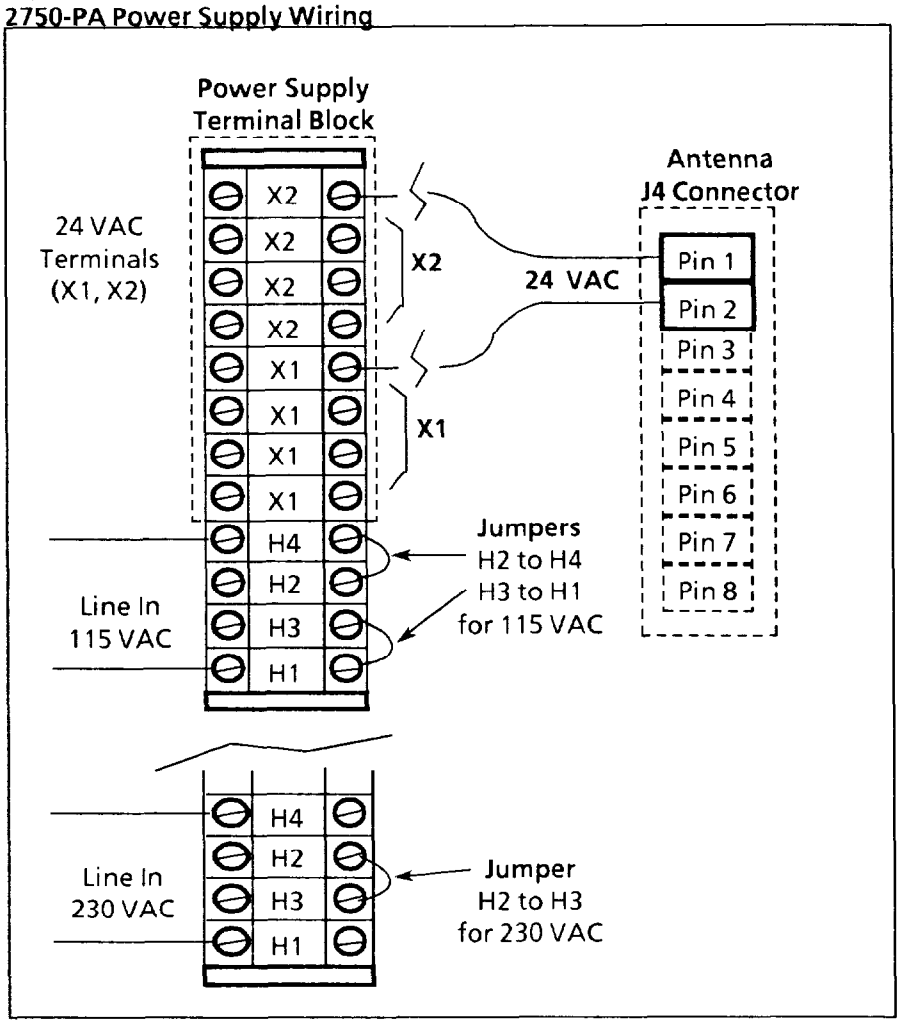
Connect the power supply to the antenna, using #14 gage electrical wire – 200 ft. maximum length for 2750-PA Power Supply. Refer to Figure 4.3:

1. Remove connector J4 from the antenna (see Figure 4.2).
2. Connect one wire from any "X2" terminal on the 2750-PA Power Supply to Pin 1 on connector J4 (see Figure 4.3). Then connect any "X1" terminal to Pin 2 on J4.
3. Plug the connector J4 into its socket.

CAUTION: To reduce susceptibility to electrical noise, do not route input lines to the antenna (24 VAC power supply, the object detect, and the host communication lines) in conduits or cable trays parallel to 115 VAC (or higher voltage) control or power lines. Route input lines across control or power lines at a 90 degree angle.

Power Supply Connection Procedure (continued)

Figure 4.3
2750-PA Power Supply Wiring



Check Power Connection

To check the power connection to the antenna:

1. Connect power to the power supply.
2. Check the diagnostic LEDs on the antenna. Several LEDs flash ON and OFF for about 30 seconds. The green POWER LED stays ON

Note: If the antenna is configured for object detect mode disabled, the OBJECT DETECT LED will remain ON also).

3. Disconnect power to the power supply.

If the LEDs did not go ON, recheck your power connections and power supply configuration. Also check power supply fuse, and antenna main fuse (see Figure 4.2).

Network Cable

Use a BELDEN #9842 cable as the communication cable. The cable is jacketed and shielded with two twisted wire pair and a drain wire. One pair provides a balanced signal line and one wire of the other pair is used for a common reference line between all nodes on the link. The shield reduces the effects of electrostatic noise.

The cable supports 2 to 32 nodes (including network master) and cannot exceed the total length of 4000 feet (1200 meters).

The communication cable consists of a number of segments daisy chained together. The number of segments you cut and prepare depends on the number of nodes in the network. Cut segments long enough to route from one node to the next with sufficient slack to prevent strain on the connector.

Follow these guidelines to help protect the communications cable from electrical interference.

- If you must run the cable across power feed lines, run the cable at right angles to the lines.
- Keep the communication cable at least:
  - 1 foot from 120V AC power lines.
  - 2 feet from 240V AC power lines.
  - 3 feet from power lines of 480V AC or more.
- Keep the communication cable at least 3 feet from electric motors, transformers, rectifiers, generators, arc welders, induction furnaces, or sources of microwave radiation.
- Route the communication cable through conduit to provide extra protection from physical damage and electrical interference.

If you route a cable through conduit, follow these recommendations:

- Use ferromagnetic conduit near critical sources of electrical interference.
- Use plastic connectors to couple between ferromagnetic conduit. Make an electrical connection around the plastic connector (use pipe clamps and heavy gauge wire or wire braid) to hold both sections at the same electrical potential.

Network Cable (Continued)

- Ground the entire length of the conduit by attaching it to the steel structure of the building.
- Do not let the conduit touch the node connector or the plug on the cable.
- The conduit should contain only serial communication cables. Loosely arrange the cables within the conduit.
- Installation must meet all applicable codes and environment specifications.

Network Termination

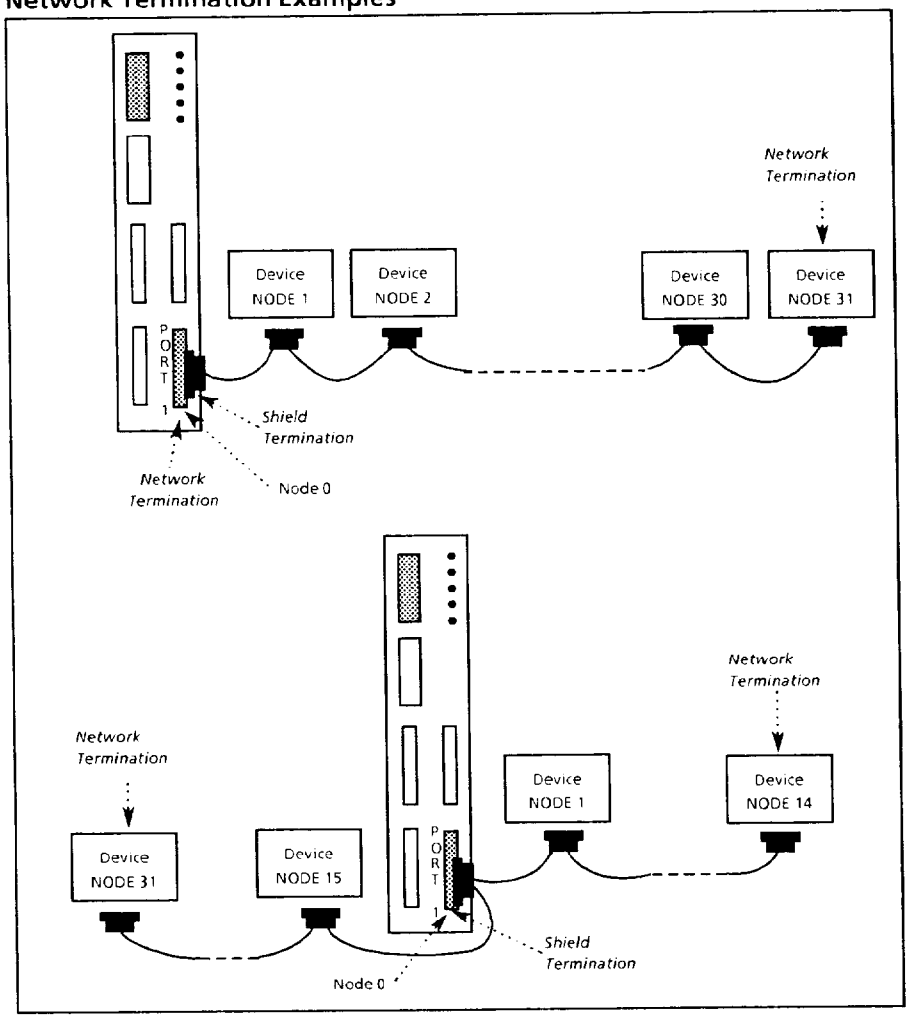
Each end of the network – the device on each end of the network – requires termination.

The network configuration determines which devices are terminated. Figure 4.4 shows the basic configurations.

- The top configuration shows port 1 at one end of the network and the device on node 30 at the other end. Port 1 and the device on node 30 require termination.
- The bottom configuration shows node 14 and node 30 at each end of the network. The devices on node 14 and 30 require termination. Port 1 does not require termination.

Network Termination (Continued)

Figure 4.4
Network Termination Examples



To terminate the antenna, jumper pin A on connector P6, refer to Figure 4.7.

Note: To terminate the network at the Flexible Interface Module, refer to the User's Manual (Publication 2760-812).

Shield Termination

Only one of the nodes in the network requires shield termination. Connect the shield of the communications cable to earth or chassis ground. Only one of the devices in the network requires an earth ground connection for the shield of the communications cable.

Note: Shield termination is typically done on the port of the Flexible Interface Module. Refer to Figure 4.7.

Connecting Host Communications

This section tells how to connect host communication to the antenna, and set antenna communication parameters. For the host side connector pin-out for the communication cable, refer to the user manual for the host or communication interface module you are using.

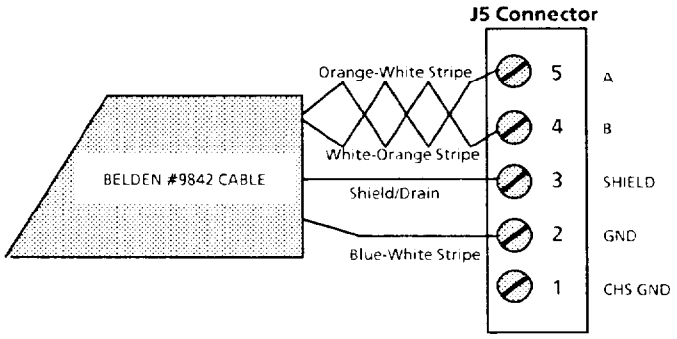
Note: Use shielded, twisted pair commmunication cable (BELDEN #9842 or equivalent).

To connect DH-485 commmunication lines to the antenna:

1. Remove connector J5 from the antenna (see Figure 4.2).

2. Connect communication wires to connector J5 as shown below. Refer to Figure 4.5.

Figure 4.5
J5 Connections on Antenna



BELDEN #9842 CABLE

For this Wire/Pair:	Connect this Wire:	To this Terminal:
Orange-White Stripe White-Orange Stripe	Orange-White Stripe	Terminal 5 (A)
	White-Orange Stripe	Terminal 4 (B)
Blue-White Stripe White-Blue Stripe	Blue-White Stripe	Terminal 1 (CHS GND)
	White-Blue Stripe	Cut back - No connection
Shield/Drain	Non-jacketed	Terminal 3 - SHLD

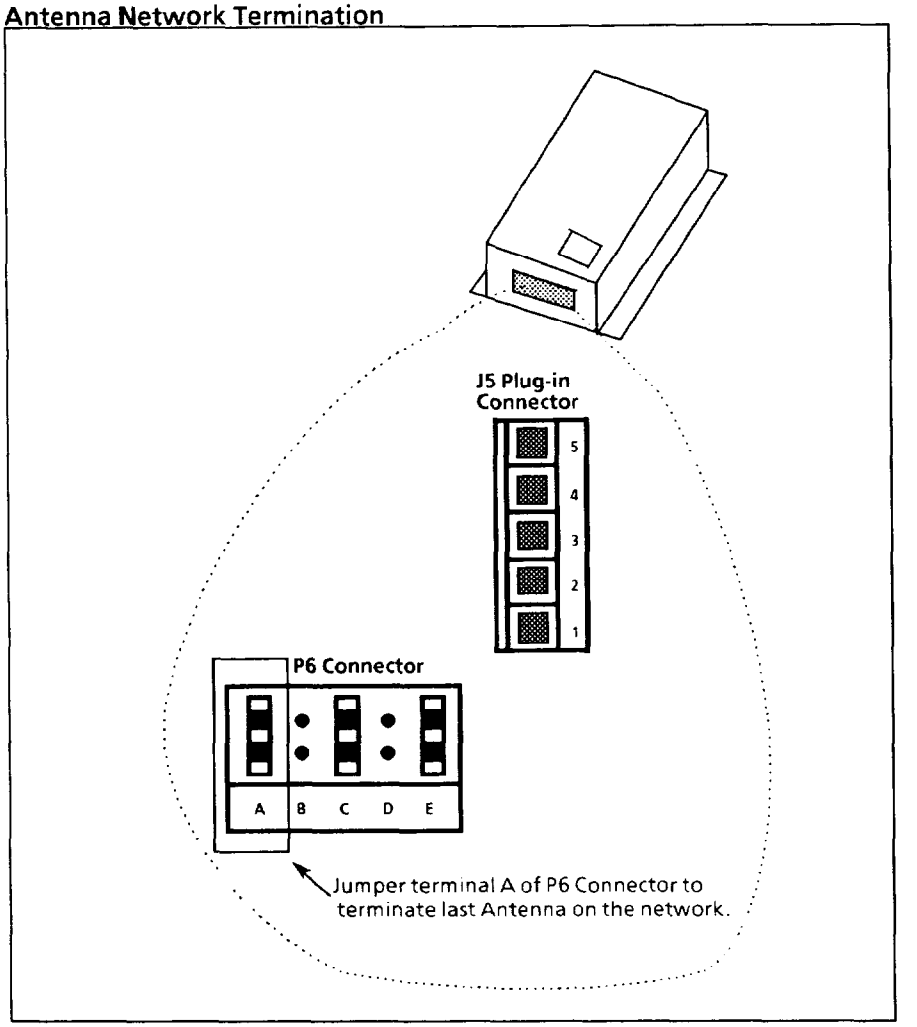
Note: Only one of the devices in the network requires an earth ground connection for the shield of the communications cable. Jumper terminals 3 and 1 together to provide shield termination. Shield termination is typically done on the port of the Flexible Interface Module.

3. Plug the connector J5 into its socket.

Connecting Host Communications (Continued)

4. If the antenna is the last device on the network, jumper pin A on connector P6. This is the DH-485 network termination jumper. Factory installed jumpers on pins C and E should already be in position. Refer to Figure 4.6.

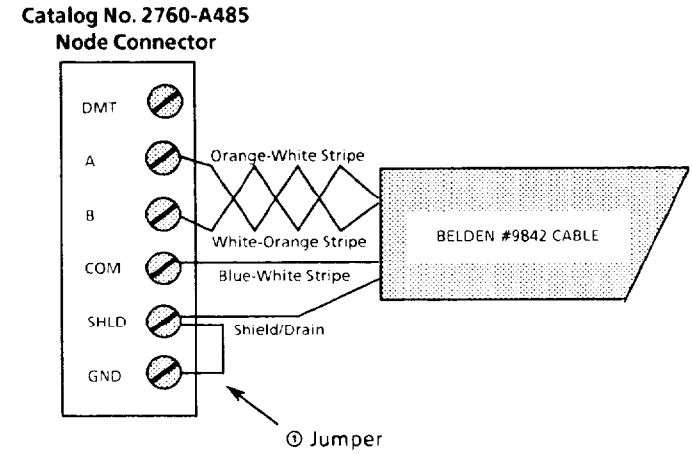
Figure 4.6
Antenna Network Termination



Connecting Network Cable to Flexible Interface Module

To connect the antenna network to the Flexible Interface Module, use one of the node connectors (Catalog No. 2760-A485) supplied with the protocol cartridge (Catalog No. 2760-SFC2). Refer to Figure 4.7 shown below.

Figure 4.7
Flexible Interface Module Connection



① Only one of the devices in the network requires an earth ground connection for the shield of the communications cable. Jumpering screws SHLD and GND together provides shield termination.

BELDEN #9842 CABLE

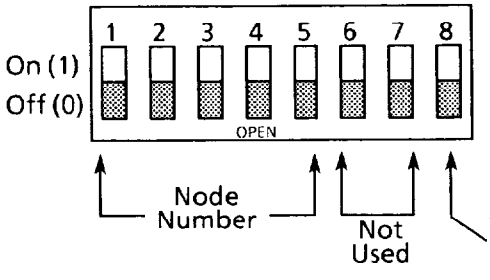
For this Wire/Pair:	Connect this Wire:	To this Terminal:
Orange-White Stripe White-Orange Stripe	Orange-White Stripe	Terminal A
	White-Orange Stripe	Terminal B
Blue-White Stripe White-Blue Stripe	Blue-White Stripe	Terminal COM
	White-Blue Stripe	Cut back - No connection
Shield/Drain	Non-jacketed	Terminal SHLD

Setting Communications Baud Rate and Node

The communications Baud Rate and Node Number of the antenna are set using the DIP switch. Figure 4.2 shows the location of the DIP switch. Refer to the illustration and tables below. Set the Node Number of the antenna using switches 1 through 5. Switches 6 and 7 are not used. Switch 8 selects the Baud Rate.

Note: Do not use the same network node number for other devices on the network.

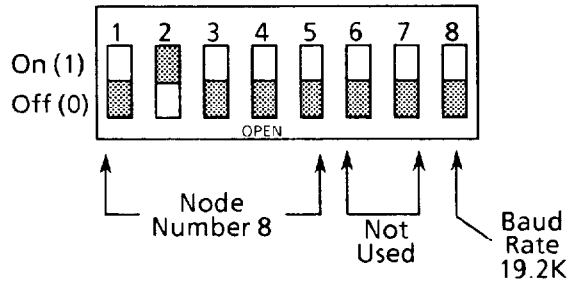
Figure 4.8
DIP Switch Settings



DIP Switch (Binary) 1	2	3	4	5	Node Number
0	0	0	0	0	0 Default
0	0	0	0	1	1
0	0	0	1	0	2
		...			
0	0	1	1	1	7
		...			
0	1	1	1	1	15
		...			
1	1	1	1	1	31

Switch 8	
0	19.2 K
1	9.6K

For example:



Connecting the Object Detect Device

The antenna can be set up to operate with an object detect device as a trigger. This section tells how to connect different types of object detect devices.

Object Detect Connection Procedure

Before you connect the object detect to the antenna, determine if the device is a two-lead or three-lead device.

Next, determine if the device operates as a current source or current sink. If necessary, consult the wiring information supplied with the device, and compare to Figure 4.9 or 4.10. For two-lead devices, refer to the connection diagrams in Figure 4.9. For three-lead devices, refer to Figure 4.10.

Note: The antenna's object detect input can provide power to object detect devices – from 10 VDC to 30 VDC, 50 mA.

CAUTION: Input voltage to the object detect must be less than 30 VDC. Higher DC or AC voltages will damage the antenna.

Once the type of device is determined:

1. For a current source device, place jumper pins at locations B and D.

2. For a current sink device, place jumper pins at locations C and E (Factory Default).

3. Connect object detect device leads to connector J4, pins 3, 4, and 5, according to type of device (i.e., current source or current sink).

Note: The user determines whether to connect a two-lead device as current source or current sink. The factory-installed setting is current sink (jumper pins at C and E).

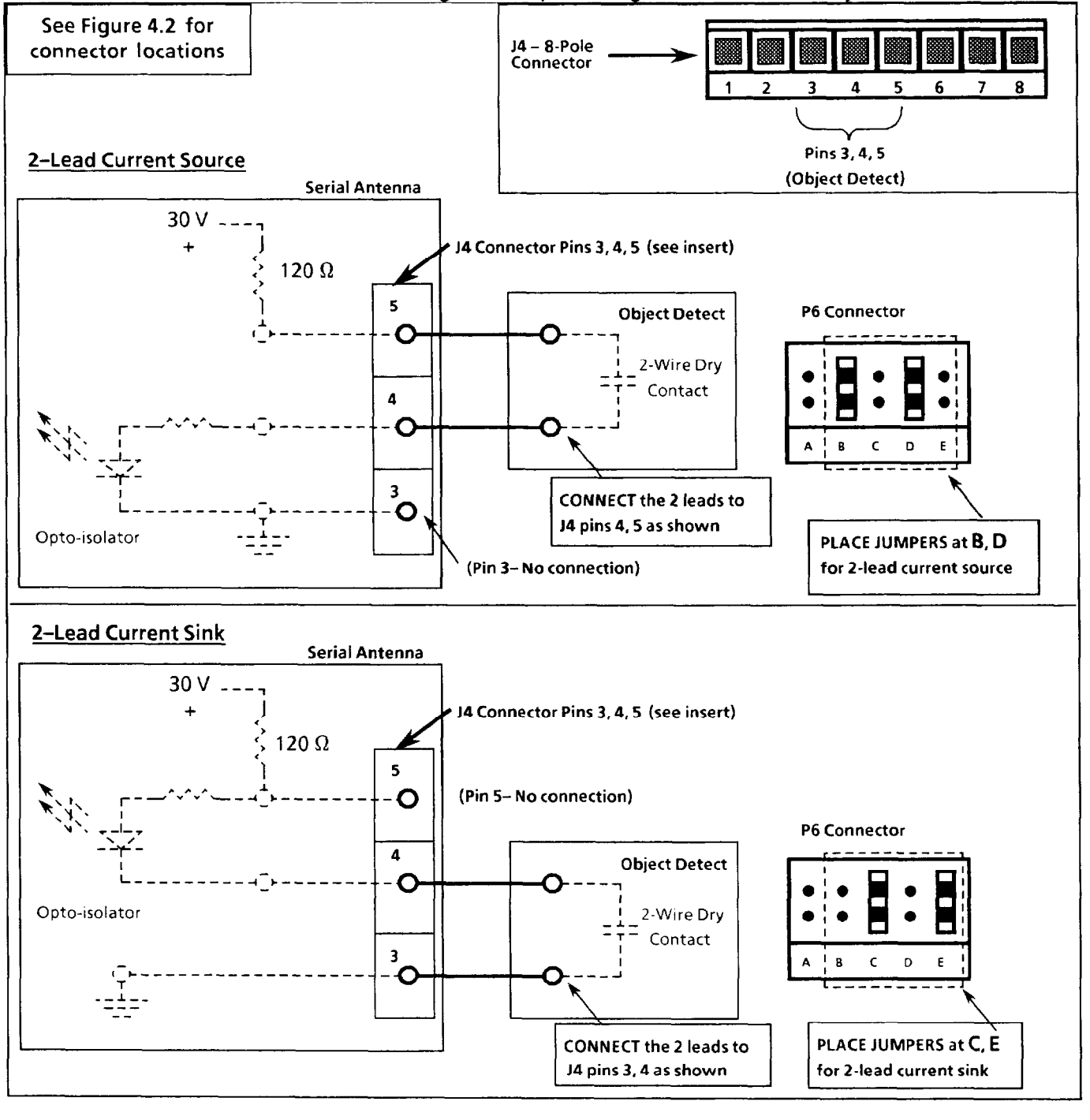
4. Plug connector J4 into its receptacle place.

Note: Pins 6, 7, and 8 on connector J4 are not used and should *not* have any wiring connected to them.

Object Detect Connection Procedure (Continued)

CAUTION: Be sure to install the P6 jumpers for the type of object detect device used. Using incorrect jumper settings or connections may damage the object detect and/or the antenna.

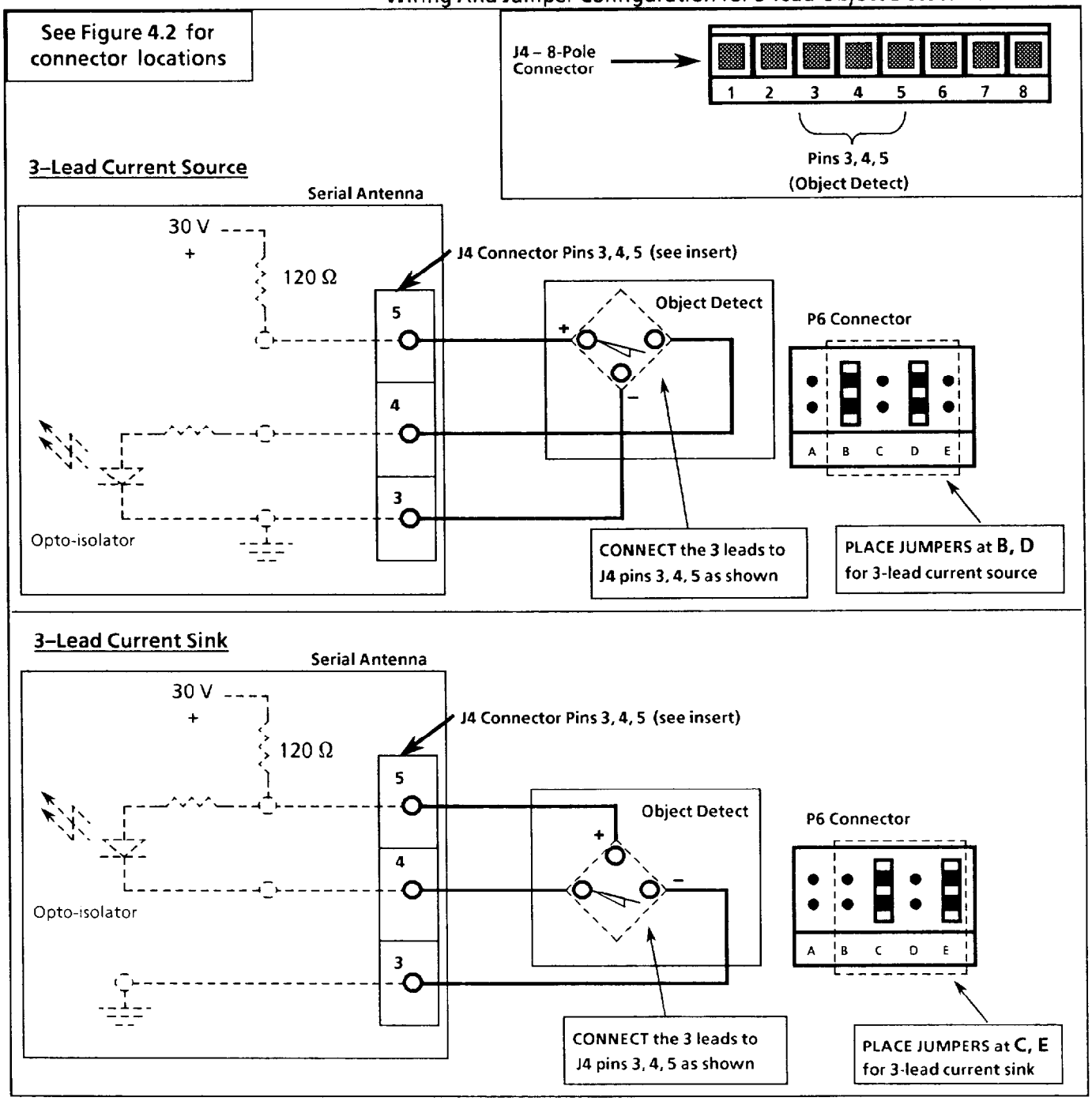
Figure 4.9
Wiring And Jumper Configuration for 2-lead Object Detect Devices



Object Detect Connection Procedure (Continued)

CAUTION: Be sure to install the P6 jumpers for the type of object detect device used. Using incorrect jumper settings or connections may damage the object detect and/or the antenna.

Figure 4.10
Wiring And Jumper Configuration for 3-lead Object Detect Devices

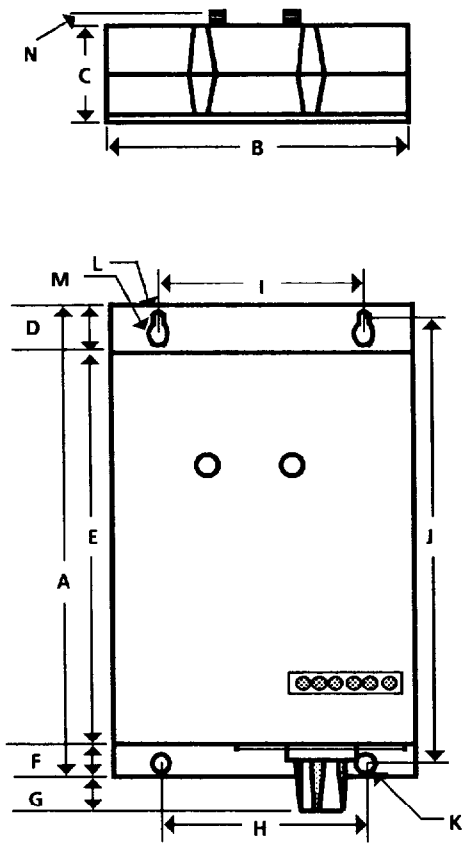


Antenna Mounting Dimensions

Antenna body mounting dimensions are shown in Figure 4.11

Note: Figure 4.11 shows Catalog No. 2750-AHD, which includes RX and TX receptacles to connect a remote head. The same body dimensions apply to other antennas without the receptacles.

Figure 4.11
Antenna Body Mounting Dimensions (2750-AHD shown).



Dimensions in Inches (mm)	
A	13.5 (342.9)
B	7.76 (197.1)
C	4.37 (111.0)
D	1.5 (38.10)
E	11.00 (279.40)
F	1.00 (25.40)
G	0.45 (11.43)
H	5.00 (127.00)
I	5.00 (127.00)
J	12.87 (326.89)
K	0.31 Dia. (7.87)
L	0.31 Dia. (7.87)
M	0.55 Dia. (13.97)
N for AHD	0.249 (6.3)

Mounting and Connecting the Remote Antenna Head

If you are using an antenna with remote head, refer to the dimensions in Figure 4.12.

Be sure to mount the antenna body within connecting distance of the remote head – the cables are 10 feet (3.05 m) in length.

Connect the remote antenna head to the antenna body using the two coaxial cables (Catalog No. 2750-C1):

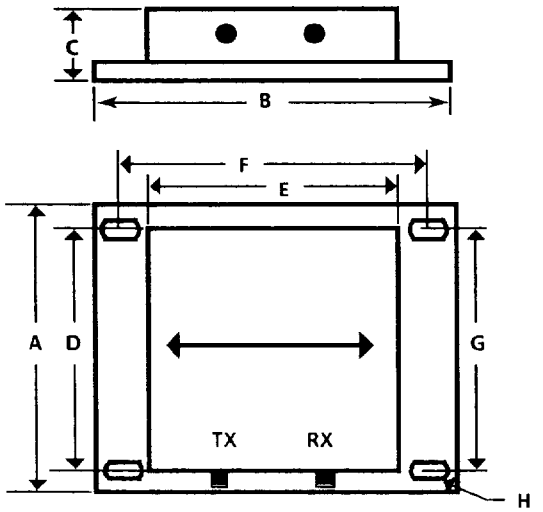
1. Connect one end of one cable to the RX connector on the antenna body. Connect the other end to the RX connector on the remote head. Torque to 7-10 inch pounds.

   Note: The minimum bend radius of the Catalog. No. 2750-C1 cable is 2 inches (51 mm). Also, route cables so that there is no tension on the cable connectors.

2. Connect the TX connectors of the antenna body and remote head with the other coaxial cable. Torque to 7-10 inch pounds.

   Note: Catalog No. 2750-C1 coaxial cable pairs are color-coded with color bands at each cable end (one cable is marked red, the other blue). If you are using more than one antenna, we suggest you use one color cable for the TX lines and the other color for RX lines throughout your system.

Figure 4.12
Remote Antenna Head Mounting Dimensions



Dimensions in Inches (mm)	
A	4.12 (104.65)
B	5.12 (130.04)
C	1.25 (31.75)
D	3.54 (89.91)
E	3.5 (88.90)
F	4.12 (104.65)
G	3.54 (89.91)
H	0.25 Dia. (6.35)

Chapter 5 Setting Up a DH-485 Network of Antennas

Chapter Objectives

This chapter shows how to set up a network of 2750-AH antennas on port 1 of the Flexible Interface Module. The network consists of three nodes; node 0, node 4, and node 5. Node 0 is module port 1. Antennas are connected as nodes 4 and 5 (refer to Figure 5.1).

The antennas operate as slave devices, responding only to data requests from another node, in this example node 0. The module port 1 directs all data from each network node to the PLC via port 5 (backplane) of the Flexible Interface Module.

Separate sections will show you how to:

1. Set correct DIP switch settings on the:
   - PLC-5/15 processor
   - 1771-I/O chassis backplane
   - Flexible Interface Module
   - 2750-AH Antennas
2. Insert Flexible Interface Module in 1771-I/O rack.
3. Connect devices to network cable.
4. Install protocol cartridge in Flexible Interface Module.
5. Connect programming terminal to Flexible Interface Module.
6. Enter configuration mode (using the programming terminal) to perform these Flexible Interface Module functions:
   - Set the Flexible Interface Module and ports to the factory defaults.
   - Verify factory defaults.
   - Activate polling for network nodes 4 and 5.
7. Exit configuration mode.
8. Enter PLC-5/15 program. A sample ladder logic program configures the antennas and enables communications between the PLC processor, Flexible Interface Module, and the antennas.

Equipment Requirements

Components of the quick start installation include:

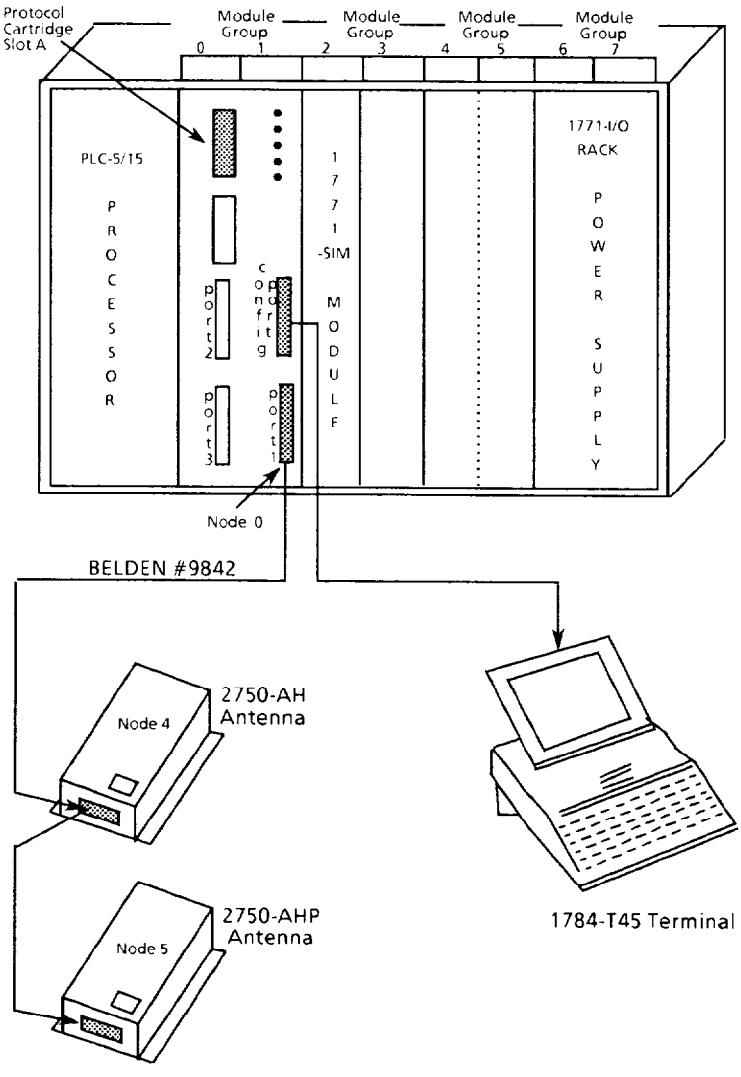
- Catalog No. 1785-LT PLC-5/15 Firmware, Series B, Revision J.
- Catalog No. 1771-I/0 chassis with power supply and Catalog No. 1771-SIM module.
- Catalog No. 2760-RB Flexible Interface Module, Series A Revision E.
- Catalog No. 1784-T45 computer with *terminal emulation* software.
- Catalog No. 2760-SFC2 Protocol Cartridge, Series B, Revision A.
- One (1) Catalog No. 2750-AH Antenna (Node 4).
- One (1) Catalog No. 2750-AHP Antenna (Node 5).
- One Catalog No. 2760-A485 Node Connector.
- Two J5 connectors (one supplied with each antenna).
- BELDEN #9842 cable.
- One (1) Catalog No. 2750-TFAW 2K, Series D, Revision B.
- One (1) Catalog No. 2750-TSHU 40, Series C, Revision A.

Figure 5.1 illustrates the quick start configuration.

- The Flexible Interface Module is installed in the 1771-I/O chassis with the PLC-5/15 processor, a 1771-I/O power supply, and a 1771-SIM module.
- The 2760-SFC2 Series B cartridge is installed in slot A of the module.
- The 1784-T45 computer with built-in *terminal emulation* software is connected to configuration port of the module.
- Port 1 of the Flexible Interface Module is configured to operate as a DH-485 network. Two antennas are connected (daisy chained) to port 1 using a BELDEN #9842 cable. Port 1 is configured to automatically poll the antennas for data and send it to the PLC.

Equipment Requirements (Continued)

Figure 5.1
Network Configuration of Antennas



Note: The 2760-RB module is a 2 slot module located in rack 0, module group 0 and 1, and addressed to slot 0. The 1771-SIM module is located in rack 0, module group 2, left slot.

1. Set DIP Switches

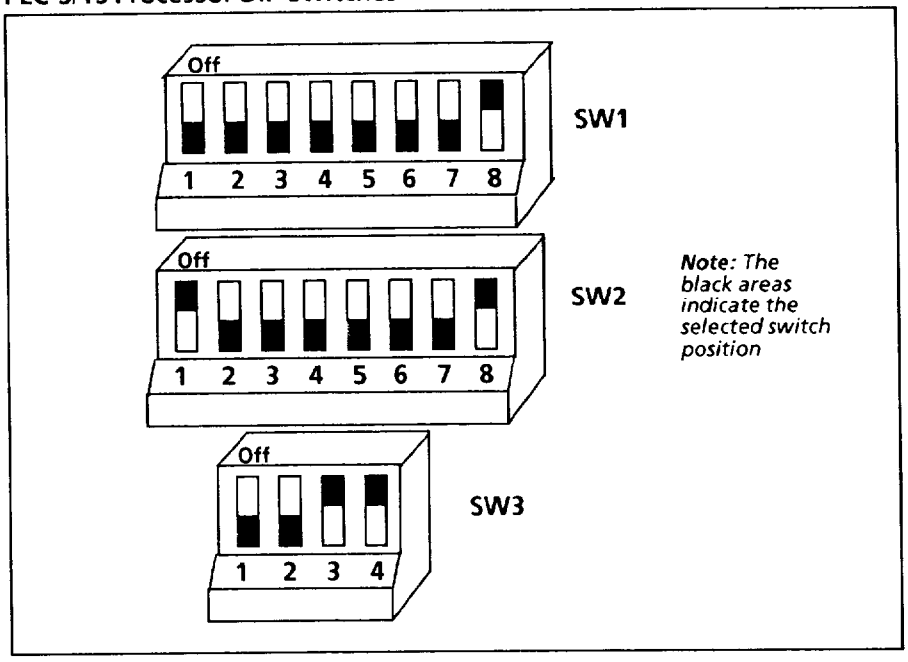
This section shows the correct switch settings for the PLC-5/15 processor, the 1771-I/O chassis, and the Flexible Interface Module.

For complete details on the installation and setup of the 1771-I/O chassis with power supply, PLC-5/15 processor, and 1771-SIM module, refer to the appropriate publications.

PLC-5/15 Processor DIP Switches

Set the PLC-5/15 processor DIP switches as shown in Figure 5.2:

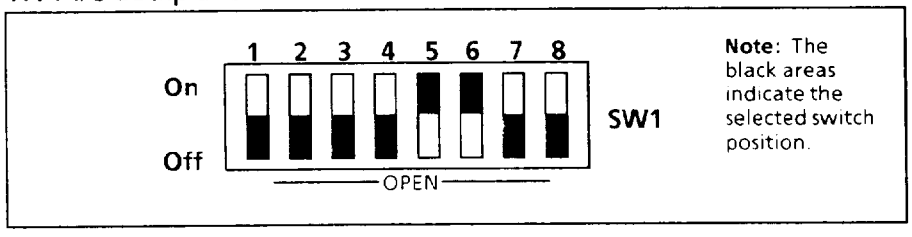
Figure 5.2
PLC-5/15 Processor DIP Switches



1771- I/O Backplane DIP Switches

Set the 1771-I/O Backplane DIP switches as shown in Figure 5.3:

Figure 5.3
1771-I/O Backplane DIP Switches

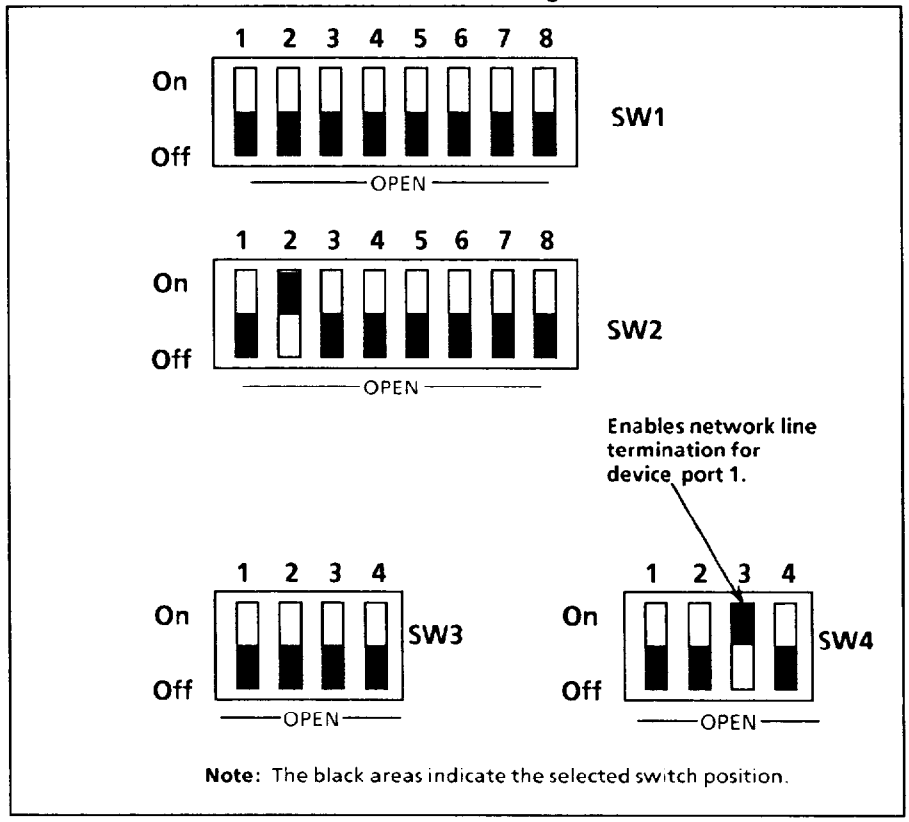


1. Set DIP Switches (Continued)

Flexible Interface Module DIP Switches

Set switches on the Flexible Interface Module as shown in Figure 5.4. You should only have to set switch 2 in group SW2 to On and switch 3 in group SW4 to On.

Figure 5.4
Flexible Interface Module DIP Switch Settings



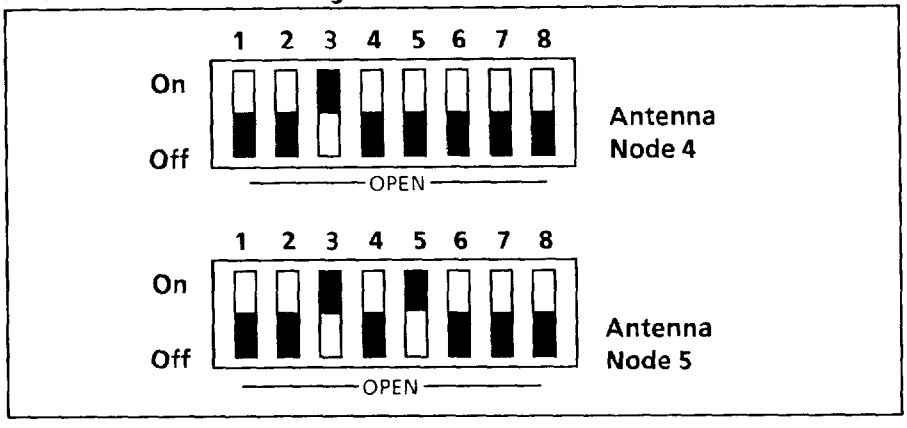
Note: The black areas indicate the selected switch position.

1. Set DIP Switches (Continued)

Antenna DIP Switches

Set switches on the antennas as shown in Figure 5.5. You should only have to set switch 3 on the Node 4 antenna to On and switches 3 and 5 on the node 5 antenna to On.

Figure 5.5
Antenna DIP Switch Settings



2. Insert Modules

Insert the Flexible Interface Module into Rack 0, Module Group 0, and address it to slot 0. The Flexible Interface Module uses two slots in the PLC controller's backplane.

Insert the 1771-SIM module into Rack 0, Module Group 2, left slot.

3. Connect Devices in Network

This section shows how to connect (daisy chain) two 2750-AH antennas to port 1 of the Flexible Interface Module. It covers:

- Network cable.
- Node connectors.
- Earth ground connection.
- Shield termination.

CAUTION: Remove power from Flexible Interface Module and antennas before installing network cable.

Network Cable

Use a BELDEN #9842 cable. Cut two cable segments long enough to route from one node to the next, allowing sufficient slack to prevent strain on connector.

Figure 5.6 shows the antennas daisy chained to port 1 of the module.

Node Connector

Use the following connectors to connect device to the cable:

- One Catalog No. 2760-A485 connector (supplied with Catalog No. 2760-SFC2 cartridge) connects cable to port 1 of Flexible Interface Module.
- Two J5 connectors (one supplied with each antenna) connect cable to DH-485 (J5) connectors on each antenna.
- One connector attaches the end of the cable segment chained from node 4 to the antenna on node 5.

Figure 5.7 shows how each connector is wired to the cable.

3. Connect Devices in Network (Continued)

Shield Termination

Only one of the nodes at the end of the network requires an earth ground connection for the shield of the communication cable. Jumper the SHLD and GND screws of the node connector that attaches to port 1. See Figure 5.7.

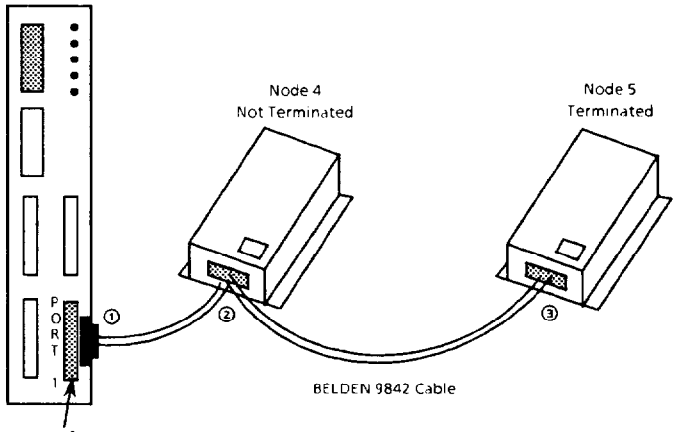
Terminating Network

Terminate the nodes at each end of the network. Port 1 (node 0) is one end. The other end is the antenna on node 5.

To terminate node 5, jumper pin A on the P6 connector.

Flexible Interafce Module DIP switches terminate device port 1. Port 1 termination was set earlier in section *Flexible Interface Module DIP Switches.*

Figure 5.6
Network Connections for Antennas

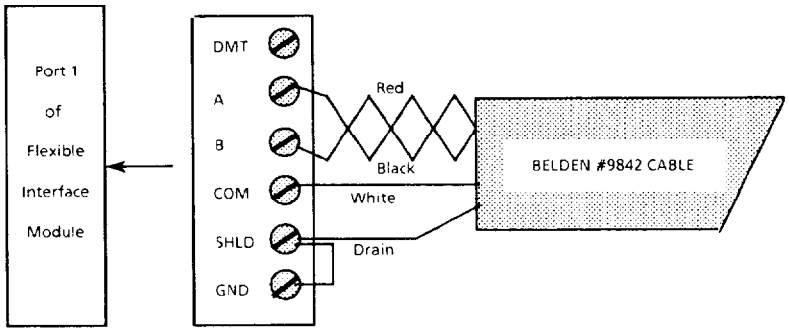


① See Figure 5.7 for wiring of node connector.
② See Figure 5.7 for wiring of node connector.
③ See Figure 5.7 for wiring of node connector.

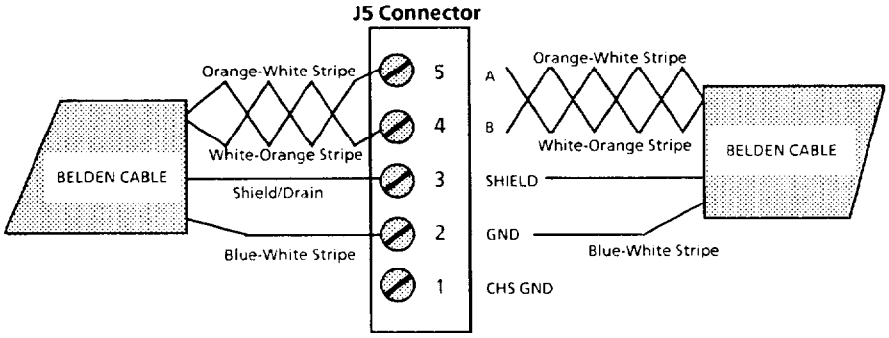
Note: DIP Switches terminate port 1 (node 0).

3. Connect Devices in Network (Continued)

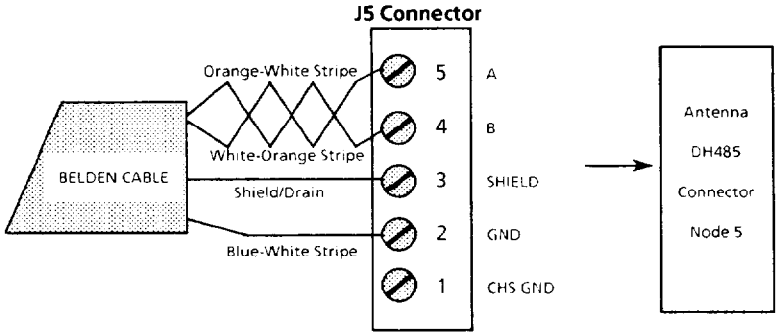
Figure 5.7
Wiring Node Connectors for Network of Antennas



① Port 1 (node 0) connection. The jumper between SHLD and GND provides an earth ground connection. DIP switches terminate port 1.



② Node 4 device connection. The antenna on node 4 is daisy chained from port 1 of module to antenna on node 5.



③ Node 5 device connection.

4. Install Protocol Cartridge

This section shows how to install the 2760-SFC2 protocol cartridge in slot A of the Flexible Interface Module.

1. **Remove system power.**

   You must remove power from Flexible Interface Module before installing the protocol cartridge.

CAUTION: To download configurations to the Flexible Interface Module ports, you must install the cartridge in the module before power-up.

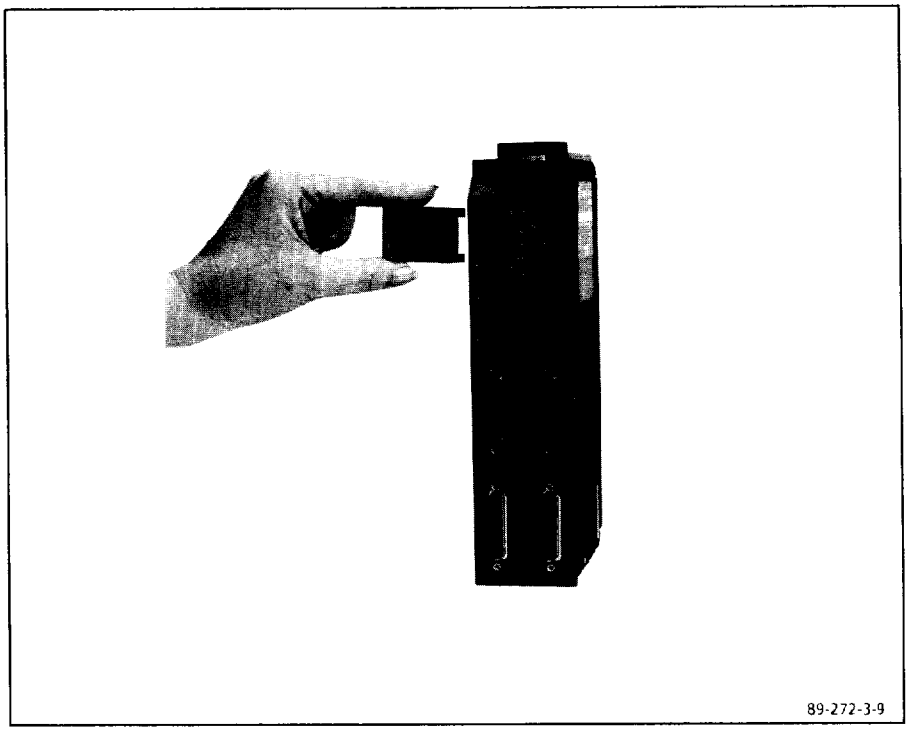
---

2. **Position cartridge for insertion.**

   Position the cartridge as shown below. The two tabs on the connector end slide into the right side of slot A (closest to the LED indicators).

3. **Insert cartridge in slot A of module.**

   Push the cartridge in until it is firmly seated. Do not exert too much pressure; pins may bend.



89-272-3-9

5. Connect Programming Terminal

This section shows how to connect the 1784-T45 terminal to the Flexible Interface Module. For specific details on the use and operation of the 1784-T45, refer to the User's Manual. For details on how to connect other programming terminals, refer to the *Flexible Interface Module User's Manual.*

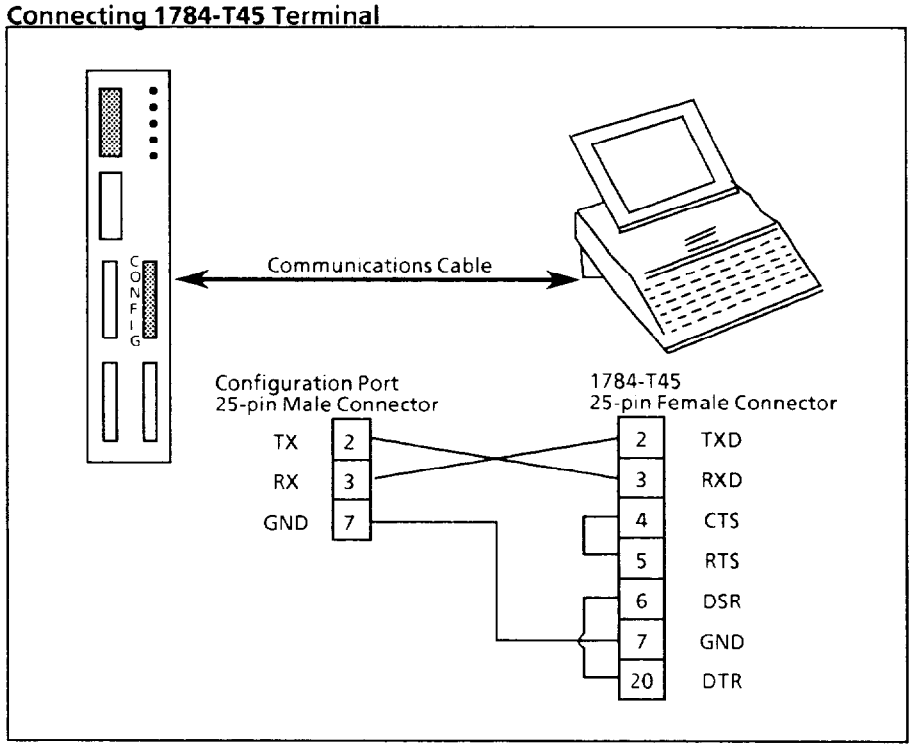
1. **Fabricate a communications cable to connect terminal to Flexible Interface Module.** Use the connector pinouts in Figure 5.8 to construct the cable.

2. **Connect terminal to configuration port of module.**

   - Attach 25-pin female connector end to the RS-232C/RS-422 port on back of the 1784-T45.

   - Attach 25-pin male connector end to the configuration port on front of module. Connect only the pins shown for the configuration port. Do *not* connect other pins.

Figure 5.8
Connecting 1784-T45 Terminal



6. Enter Configuration Mode

This section shows how to setup the programing terminal and enter configuration mode of the Flexible Interface Module.

Follow these steps:

1. **Apply system power to module.**

   Apply power to the 1771-I/O rack.

   All module LED indicators turn red and then the:

   - CONFIG PORT RDY LED turns steady green.
   - ACTIVE/FAULT LED flashes green.

   Ignore the state of the PORT 1 RDY, PORT 2 RDY, PORT 3 RDY LEDs at this time.

2. **Apply power to antennas.**

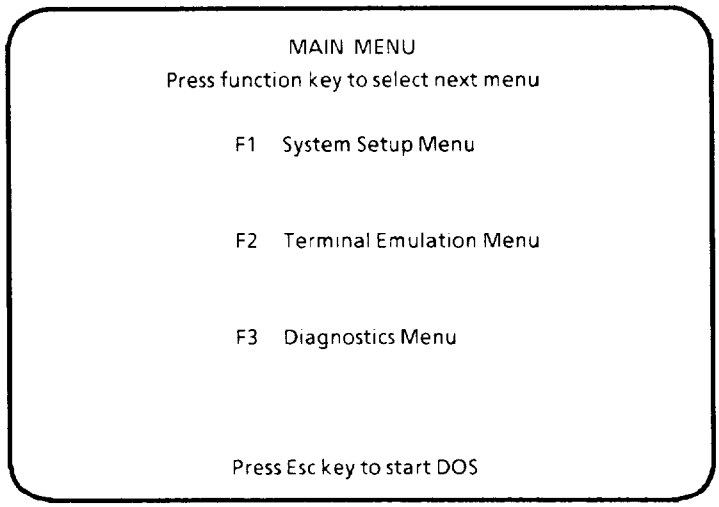
3. **Power on the 1784-T45 terminal.**

The power switch is located on the left side of the unit. The terminal beeps once and then tests itself. When the test is complete, a message appears. The last line should indicate that all tests have passed.

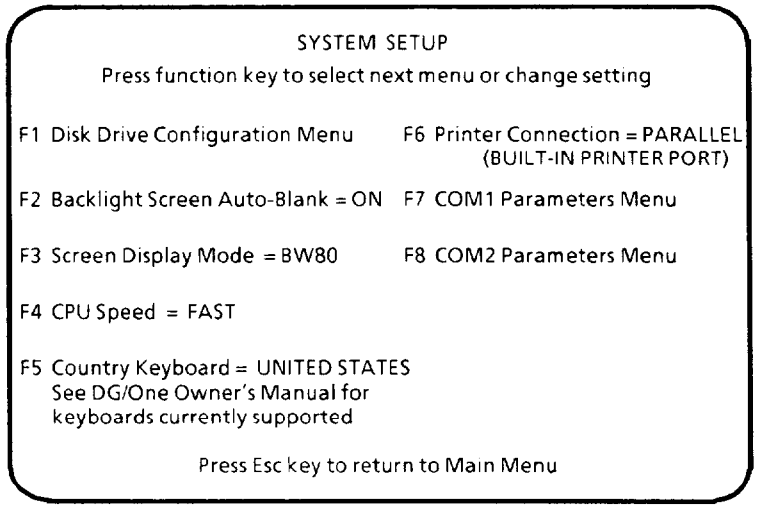
6. Enter Configuration Mode (continued)

4. **Press the [Ctrl] [Alt] [Cmd] key sequence to display the system Main Menu.**

   (Press the [Ctrl] key while holding down both the [Alt] key and the [Cmd] keys.)

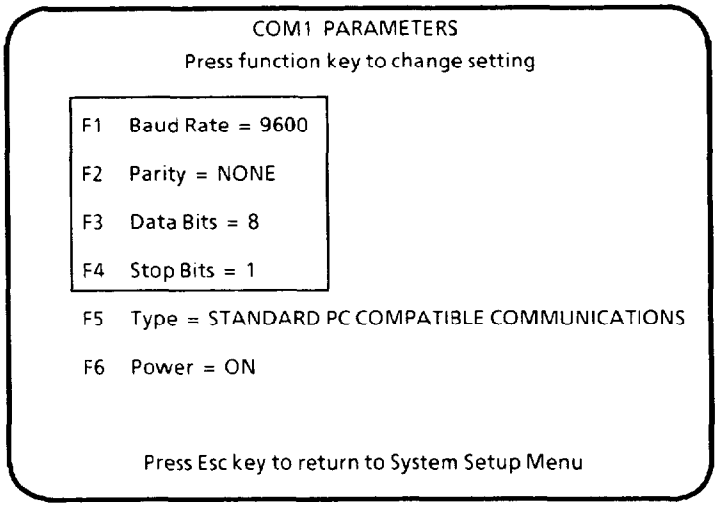

MAIN MENU
Press function key to select next menu
F1 System Setup Menu
F2 Terminal Emulation Menu
F3 Diagnostics Menu
Press Esc key to start DOS

5. **Press [F1] to access the System Setup Menu.** Edit settings to match those on this screen.


SYSTEM SETUP
Press function key to select next menu or change setting
F1 Disk Drive Configuration Menu
F2 Backlight Screen Auto-Blank = ON
F3 Screen Display Mode = BW80
F4 CPU Speed = FAST
F5 Country Keyboard = UNITED STATES
See DG/One Owner's Manual for
keyboards currently supported
F6 Printer Connection = PARALLEL
(BUILT-IN PRINTER PORT)
F7 COM1 Parameters Menu
F8 COM2 Parameters Menu
Press Esc key to return to Main Menu

6. Enter Configuration Mode (Continued)

6. **Press [F7] to access the COM1 Parameters Menu.**


COM1 PARAMETERS
Press function key to change setting
F1 Baud Rate = 9600
F2 Parity = NONE
F3 Data Bits = 8
F4 Stop Bits = 1
F5 Type = STANDARD PC COMPATIBLE COMMUNICATIONS
F6 Power = ON
Press Esc key to return to System Setup Menu

The communication settings in the box match the default settings of the configuration port. Don't change the other settings. If the configuration port settings are different, make the necessary changes before going on to next step.

7. **Press [Esc] to return to the System Setup Menu.**

8. **Press [Esc] to return to the Main Menu.**

6. Enter Configuration Mode (Continued)

9. **Press [F2] to access the Terminal Emulation Menu.**

   Edit settings to match those on this screen.

```
                    TERMINAL EMULATION
        Press function key to select next menu or change setting

F1 Terminal = STANDARD              F6 Print = OFF

F2 Modem = EXTERNAL                 F7 Auto NewLine = OFF

F3 OFC (Flow Control) = OFF

F4 Duplex = FULL

F5 Disconnect                       TO GO ON-LINE


                Press Esc key to return to Main Menu.
```

10. **Press [ ] to go on-line.** The screen clears. On other terminals, this key is labeled [RETURN] or [ENTER].

    Note: With the terminal in emulation mode, the last line on every screen will show:

    ```
    Ctrl-Esc to Go Off-Line      Std Terminal
    ```

    You are now ready to enter configuration mode.

11. **Hold down the [Alt] key and press [B].**

    This message appears:

    ```
    PRESS ANY KEY IN 60 SECONDS TO BEGIN 2760-RB MODULE
    CONFIGURATION
    ```

    You have 60 seconds to enter configuration mode. The screen updates the time every three seconds.

6. Enter Configuration Mode (Continued)

12. **Press any key (before the 60 seconds elapse) to access the configuration menu.**

If you don't press a key within 60 seconds, you will not enter configuration mode. Repeat step 11.

```
                    2760-RB        SERIES X    REVISION X
COPYRIGHT 1989                          ALLEN-BRADLEY COMPANY, INC.
-------------------------------------------------------------------------

1X   - CONFIGURATION PARAMETERS          2X   - IDENTIFICATION NUMBERS
3    - DEVICE PORT PROTOCOL NAMES        4DM  - MATCH CODE ENTRIES
5I   - DISCRETE BYTE INPUT ENTRIES       6    - THE DATA MATRIX ENTRIES
7    - THE PASS THROUGH ENTRIES          8    - NON-VOLATILE SCRATCH PAD AREA
9XF  - RB MODULE FUNCTIONS               AX   - HARDWARE DIAGNOSTICS
BX   - SOFTWARE DIAGNOSTICS              C    - EXIT CONFIGURATION MODE

WHERE X (0 TO 7) AND D (1 TO 3) ARE PORT NUMBERS WHICH ARE DEFINED BELOW :

0 - RB CMMND PRCSS  2 - SERIAL PORT 2  4 - CONFIG. PORT   6 - I/O RACK SLT 1
1 - SERIAL PORT 1   3 - SERIAL PORT 3  5 - I/O RACK SLT 0  7 - RESERVED

WHERE F (A TO E) ARE FUNCTIONS THE RB CAN PERFORM WHICH ARE DEFINED BELOW :

A - RESET  B - SET DEFAULTS  C - FLUSH  D - INITIALIZE  E - CLEAR DIAGS

WHERE M (A TO T) AND I (A TO H) ARE ENTRY NUMBERS FOR THE SELECTION MADE ABOVE.

                    ENTER A MAIN MENU SELECTION: _
```

6a. Set Factory Defaults

This section shows how to set the Flexible Interface Module and device ports to their factory defaults. A default configuration is downloaded to each port.

1. **Select menu option 90B to set the device ports to the factory defaults.**

```
                    2760-RB        SERIES X    REVISION X
          COPYRIGHT 1989                  ALLEN-BRADLEY COMPANY, INC.
-------------------------------------------------------------------------

1X   - CONFIGURATION PARAMETERS          2X   - IDENTIFICATION NUMBERS
3    - DEVICE PORT PROTOCOL NAMES        4DM  - MATCH CODE ENTRIES
5I   - DISCRETE BYTE INPUT ENTRIES       6    - THE DATA MATRIX ENTRIES
7    - THE PASS THROUGH ENTRIES          8    - NON-VOLATILE SCRATCH PAD AREA
9XF  - RB MODULE FUNCTIONS               AX   - HARDWARE DIAGNOSTICS
BX   - SOFTWARE DIAGNOSTICS              C    - EXIT CONFIGURATION MODE

WHERE X (0 TO 7) AND D (1 TO 3) ARE PORT NUMBERS WHICH ARE DEFINED BELOW :

0 - RB CMMND PRCSS  2 - SERIAL PORT 2  4 - CONFIG. PORT   6 - I/O RACK SLT 1
1 - SERIAL PORT 1   3 - SERIAL PORT 3  5 - I/O RACK SLT 0  7 - RESERVED

WHERE F (A TO E) ARE FUNCTIONS THE RB CAN PERFORM WHICH ARE DEFINED BELOW :

A - RESET  B - SET DEFAULTS  C - FLUSH  D - INITIALIZE  E - CLEAR DIAGS

WHERE M (A TO T) AND I (A TO H) ARE ENTRY NUMBERS FOR THE SELECTION MADE ABOVE.

                ENTER A MAIN MENU SELECTION: 90B [RETURN]
```

You exit configuration mode and the screen displays:

```
EXIT 2760-RB MODULE CONFIGURATION
```

The device ports are automatically set to their default settings. All of the module LED indicators turn red. Within a short time, the device port LEDs turn green, the configuration port LED turns green, and the ACTIVE/FAULT LED flashes green.

2. **Hold down the [Alt] key and press [B] (Break) to re-enter configuration mode and the main menu.**

6b. Verify Factory Defaults

Verify that the factory defaults are set for port 1.

1. **Select menu option "3 - Device Port Protocol Names" to verify that DH-485 protocol is assigned to port 1.**

```
ENTER A MAIN MENU SELECTION: 3 [RETURN]

PORT 1 = COPYRIGHT 1991, 1990  ALLEN-BRADLEY COMPANY, INC.
2760-SFC2 DH485 , SERIES B , REVISION B  (YES/NO) = YES.

PORT 2 = COPYRIGHT 1991, 1990  ALLEN-BRADLEY COMPANY, INC.
2760-SFC2 DT  , SERIES B , REVISION B  (YES/NO) = YES.

PORT 3 = COPYRIGHT 1991, 1990  ALLEN-BRADLEY COMPANY, INC.
2760-SFC2 DH485 , SERIES B , REVISION B  (YES/NO) = YES.

EDIT THIS SELECTION (YES/NO)?  N [RETURN]
```

The listing should show DH-485 for port 1. Enter N to return to the main menu.

Note: If another protocol is assigned to port 1, make sure the 2760-SFC2 cartridge is the only cartridge in the module and select menu option 90B to set the device ports to their factory defaults. Select menu option 3 again. The listing should appear as the one above.

2. **Select menu option "21 - Identification Numbers" to identify the network of devices to operate on port 1.**

```
ENTER A MAIN MENU SELECTION: 21 [RETURN]

CATEGORY 1 ASCII DEVICES (2755-DM6/9) 0h, (YES/NO) = YES.

EDIT THIS SELECTION?          Y [RETURN]
CATEGORY 1 ASCII DEVICES (2755-DM6/9) 0h, (YES/NO) = YES = ? N [RETURN]
CATEGORY 1 PCCC DEVICES (2755-DM6/9) 1h, (YES/NO) = YES = ? N [RETURN]
CATEGORY 1 IDP DEVICES (2750-AH) 2h, (YES/NO) = YES = ? Y [RETURN]
```

This network requires category 1 slave devices on the link using IDP protocol. The 2750-AH antenna is a slave that uses IDP protocol. The Flexible Interface Module port operates as the master to all antennas on the network.

6c. Activate Polling of Nodes

This section shows how to activate automatic polling of nodes 4 and 5 on the network. All data the module receives from nodes 4 and 5 is sent to the PLC using block transfers.

1. **Select option "11 - Configuration Parameters" from the main menu.** The parameters you need to modify are flagged by arrows.

```
NODE  0 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE  1 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE  2 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE  3 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE  4 POLLING FREQUENCY (DEC 0 ... 200) = 0.  <-
NODE  5 POLLING FREQUENCY (DEC 0 ... 200) = 0.  <-
NODE  6 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE  7 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE  8 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE  9 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE 10 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE 11 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE 12 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE 13 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE 14 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE 15 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE 16 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE 17 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE 18 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE 19 POLLING FREQUENCY (DEC 0 ... 200) = 0.
NODE 20 POLLING FREQUENCY (DEC 0 ... 200) = 0.

CONTINUE THIS SELECTION (YES/NO) ? N [RETURN]

EDIT THIS SELECTION (YES/NO) ? Y [RETURN]
```

2. **Enter N** (as shown above) **to discontinue the display.**

3. **Enter Y at the next prompt** (as shown above) **to edit the selection.**

Questions then display line by line for each node.

6c. Activate Polling of Nodes (Continued)

4. **Enter [RETURN] to accept a default value of 0 for Node 0.** Node 0 is the Flexible Interface Module Port and should not be polled. The next question displays.

```
NODE 0 POLLING FREQUENCY (DEC 0 . . . 200) = 0 = ? [RETURN]
```

5. **Enter [RETURN] until the prompt for the node 4 polling frequency is displayed. Then enter 1 and [RETURN] to activate automatic polling for node 4.** The value 1 means the module will poll node 1 for data every polling cycle. The next question displays.

```
NODE 1 POLLING FREQUENCY (DEC 0 . . . 200) = 0 = ? [RETURN]
NODE 2 POLLING FREQUENCY (DEC 0 . . . 200) = 0 = ? [RETURN]
NODE 3 POLLING FREQUENCY (DEC 0 . . . 200) = 0 = ? [RETURN]
NODE 4 POLLING FREQUENCY (DEC 0 . . . 200) = 0 = ? 1 [RETURN]
```

6. **Enter 1 and [RETURN] to activate automatic polling for node 5.**

```
NODE 5 POLLING FREQUENCY (DEC 0 . . . 200) = 0 = ? 1 [RETURN]
```

6. **Enter SAVE and [RETURN] at next question to save the changes and return to the main menu.**

```
NODE 6 POLLING FREQUENCY (DEC 0 . . . 200) = 0 = ? SAVE [RETURN]

PRESS THE RETURN KEY TO CONTINUE.
```

7. Exit Configuration Mode

Now that the module and port 1 are configured, you can exit configuration mode.

Select menu option "C- Exit Configuration Mode" to exit the main menu and configuration mode.

8. Enter PLC-5/15 Program

This section contains a sample ladder logic program to enable communications between the PLC processor, Flexible Interface Module, and Intelligent Antenna.

Program Description

The program contains four different types of commands to perform antenna operations:

1. **Two Set Antenna Configuration commands**
   - The first command configures the antenna (node #4) to operate with a 2K read/write tag.
   - The second command configures the antenna (node #5) to operate with a 20 character programmable tag.

   Both commands configure the antenna for object detect disabled with a 3 second object detect timeout.

2. **Two Write (once) commands**
   - The first write command (node #4) writes 10 bytes to the 2K read/write tag.
   - The second write command (node #5) writes 20 characters to the programmable tag.

   The number of bytes and the starting tag address for each write command varies.

3. **Two Read (Once) commands**
   - The first read command (node #4) reads 10 bytes from the 2K read/write tag.
   - The second read command (node #5) reads 20 characters from the programmable tag.

   The number of bytes and the starting tag address for each read command varies.

4. **Two Reset commands**
   - Resets antenna (node #4).
   - Resets antenna (node #5).

8. Enter PLC-5/15 Program (Continued)

Program Description (Continued)

The program uses 1 slot addressing and the following input switch addresses of the 1771-SIM module to send the commands to the antenna.

I:001/00 Configures antenna (node 4) for the 2K read/write tag.

I:001/01 Configures antenna (node 5) for the 20 character programmable tag.

I:001/02 Writes 10 bytes to the 2K read/write tag (node 4).

I:001/03 Writes 20 characters to the programmable tag (node 5).

I:001/04 Reads 10 bytes from the 2K read/write tag (node 4).

I:001/05 Reads 20 characters from the programmable tag.

I:001/06 Resets antenna (node 4).

I:001/07 Resets antenna (node 5).

When each antenna has been configured for one of the two tag types: 2K read/write (*node 4)* or 20 character programmable (*node 5*), you can send the appropriate read or write command to the antenna.

When the antenna receives a write command, it performs the write operation until successful or the timeout expires. The PLC BTR data file will not receive a response to the write command until the write operation is successful or the command times out.

When the antenna receives a read command, it performs the read operation until successful or the timeout expires. The PLC BTR data file will not receive a response to the read command until the read operation is sucessful or times out.

The sections that follow show the:

- Command file for each antenna command and their address locations in the PLC- 5/15 data table.
- Ladder logic program
- PLC- 5/15 data table

8. Enter PLC-5/15 Program (Continued)

PLC Command Files
Set Antenna Configuration Command - 2K Read/Write Tag (Node 4)

The following command file contains a Set Antenna Configuration command for a 2K read/write tag. Enter the command data into the PLC-5/15 data table starting at address N7:300. Use the BCD/Hex screen to enter the data. PLC data tables are shown on pages 5-34 to 5-36.

For complete details on the Set Configuration command, refer to Chapter 7

Word Offset	High Byte	Low Byte	
0	00	28	*Byte Count = 0028*
1	05	01	*Source Port = 05 Dest. Port = 01*
2	00	04	*Source Node = 00 Dest. Node = 04*
3	80	80	*Source LSAP = 80 Dest. LSAP = 80*
4	00	07	*Reserved = 00 Commnad = 07* Set Antenna Configuration
5	00	00	*Reserved = 00 Reserved = 00*
6	00	00	*Sequence #, LSB = 00, MSB = 00*
7	00	00	*Sensor #, LSB = 00, MSB = 00*
8	00	00	*Reserved = 00 Reserved = 00*
9	10	00	*Tag Type = 10 Reserved = 00*
10	00	00	*Read Only = 00 Read Only = 00*
11	00	00	*Object Detect = 00 Reserved = 00*
12	28	00	*Timeout, LSB = 28, MSB = 00*
13	01	00	*RF Field = 01, Reserved = 00*

8. Enter PLC-5/15 Program (Continued)

PLC Command Files (continued)
Set Antenna Configuration Command - 20 Character Programmable Tag (Node 5)

The following command file contains a Set Antenna Configuration command for a 20 character programmable tag. Enter the command data into the PLC-5/15 data table starting at address N7:320. Use the BCD/Hex screen to enter the data. PLC data tables are shown on pages 5-34 to 5-36.

For complete details on the Set Configuration command refer to Chapter 7.

Word Offset	High Byte	Low Byte	
0	00	28	*Byte Count = 0028*
1	05	01	*Source Port = 05 Dest. Port = 01*
2	00	05	*Source Node = 00 Dest. Node = 05*
3	80	80	*Source LSAP = 80 Dest. LSAP = 80*
4	00	07	*Reserved = 00 Commnad = 07 Set Antenna Configuration*
5	00	00	*Reserved = 00 Reserved = 00*
6	00	00	*Sequence #, LSB = 00, MSB = 00*
7	00	00	*Sensor #, LSB = 00, MSB = 00*
8	00	00	*Reserved = 00 Reserved = 00*
9	21	00	*Tag Type = 21 Reserved = 00*
10	00	00	*Read Only = 00 Read Only = 00*
11	00	00	*Object Detect = 00 Reserved = 00*
12	28	00	*Timeout, LSB = 28, MSB = 00*
13	01	00	*RF Field = 01, Reserved = 00*

8. Enter PLC-5/15 Program (Continued)

PLC Command Files (continued)
Antenna Write Command - 2K Read/Write Tag (Node 4)

The following command file contains a Write command to write 10 bytes to a 2K read/write tag. Enter the command data into the PLC-5/15 data table starting at address N7:340. Use the BCD/Hex screen to enter the data. PLC data tables are shown on pages 5-34 to 5-36.

For complete details on the Repeat Read command, refer to Chapter 7.

Word Offset	High Byte	Low Byte	
0	00	34	*Byte Count = 0034*
1	05	01	*Source Port = 05 Dest. Port = 01*
2	00	04	*Source Node = 00 Dest. Node = 04*
3	80	80	*Source LSAP = 80 Dest. LSAP = 80*
4	01	08	*Repeat Count = 01 Commnad = 08 Perform Command*
5	00	00	*Reserved = 00 Reserved = 00*
6	00	00	*Sequence #, LSB = 00, MSB = 00*
7	00	00	*Sensor #, LSB = 00, MSB = 00*
8	00	01	*Reserved = 00 Operation = 01 Write, None to follow*
9	00	00	*Reserved = 00 Reserved = 00*
10	20	00	*Start Address, LSB = 20, MSB = 00*
11	0A	00	*Length, LSB = 0A, MSB = 00*
12	30	39	*Data Byte 0 = 30, Data Byte 1 = 39*
13	38	37	*Data Byte 2 = 38, Data Byte 3 = 37*
14	36	35	*Data Byte 4 = 38, Data Byte 5 = 37*
15	34	33	*Data Byte 6 = 38, Data Byte 7 = 37*
16	32	31	*Data Byte 8 = 38, Data Byte 9 = 37*

8. Enter PLC-5/15 Program (Continued)

PLC Command Files (continued)
Antenna Write Command - Programmable Tag (Node 5)

The following command file contains a Write command to write 20 characters to a programmable tag. Enter the command data into the PLC-5/15 data table starting at address N7:360. Use the BCD/Hex screen to enter the data. PLC data tables are shown on pages 5-34 to 5-36.

For complete details on the Repeat Read command, refer to Chapter 7.

Word Offset	High Byte	Low Byte	
0	00	44	*Byte Count = 0044*
1	05	01	*Source Port = 05 Dest. Port = 01*
2	00	05	*Source Node = 00 Dest. Node = 05*
3	80	80	*Source LSAP = 80 Dest. LSAP = 80*
4	01	08	*Repeat Count = 01 Commnad = 08 Perform Command*
5	00	00	*Reserved = 00 Reserved = 00*
6	00	00	*Sequence #, LSB = 00, MSB = 00*
7	00	00	*Sensor #, LSB = 00, MSB = 00*
8	00	01	*Reserved = 00 Operation = 01 Write, None to follow*
9	00	00	*Reserved = 00 Reserved = 00*
10	00	00	*Start Address, LSB = 00, MSB = 00*
11	14	00	*Length, LSB = 14, MSB = 00*
12	30	31	*Data Byte 0 = 30, Data Byte 1 = 31*
13	32	33	*Data Byte 2 = 32, Data Byte 3 = 33*
14	34	35	*Data Byte 4 = 34, Data Byte 5 = 35*
15	36	37	*Data Byte 6 = 36, Data Byte 7 = 37*
16	38	39	*Data Byte 8 = 38, Data Byte 9 = 39*
17	41	42	*Data Byte 10 = 41, Data Byte 11 = 42*
18	43	44	*Data Byte 12 = 43, Data Byte 13 = 44*
19	45	46	*Data Byte 14 = 45, Data Byte 15 = 46*
20	47	48	*Data Byte 16 = 47, Data Byte 17 = 48*
21	49	50	*Data Byte 18 = 49, Data Byte 19 = 50*

8. Enter PLC-5/15 Program (Continued)

PLC Command Files (continued)
Antenna Read (Once) Command - 2K Read/Write Tag (Node 4)

The following command file contains a Read (once) command to read 10 bytes of data from a 2K read/write tag. Enter the command data into the PLC-5/15 data table starting at address N7:390. Use the BCD/Hex screen to enter the data. PLC data tables are shown on pages 5-34 to 5-36.

For complete details on the Read (once) command, refer to Chapter 7.

Word Offset	High Byte	Low Byte	
0	00	34	*Byte Count = 0034*
1	05	01	*Source Port = 05 Dest. Port = 01*
2	00	04	*Source Node = 00 Dest. Node = 04*
3	80	80	*Source LSAP = 80 Dest. LSAP = 80*
4	01	08	*Repeat Count = 01 Commnad = 08 Perform Command*
5	00	00	*Reserved = 00 Reserved = 00*
6	00	00	*Sequence #, LSB = 00, MSB = 00*
7	00	00	*Sensor #, LSB = 00, MSB = 00*
8	00	00	*Reserved = 00 Operation = 00 Read, None to follow*
9	00	00	*Reserved = 00 Reserved = 00*
10	20	00	*Start Address, LSB = 20, MSB = 00*
11	0A	00	*Length, LSB = 0A, MSB = 00*
12	00	00	*Reserved Byte 0 = 00, 1 = 00*
13	00	00	*Reserved Byte 2 = 00, 3 = 00*
14	00	00	*Reserved Byte 4 = 00, 5 = 00*
15	00	00	*Reserved Byte 6 = 00, 7 = 00*
16	00	00	*Reserved Byte 8 = 00, 9 = 00*

8. Enter PLC-5/15 Program (Continued)

PLC Command Files (continued)
Antenna Read (Once) Command - Programmable Tag (Node 5)

The following command file contains a Read (once) command to read 20 characters from a programmable tag. Enter the command data into the PLC-5/15 data table starting at address N7:410. Use the BCD/Hex screen to enter the data. PLC data tables are shown on pages 5-34 to 5-36.

For complete details on the Read (once) command, refer to Chapter 7.

Word Offset	High Byte	Low Byte	
0	00	44	*Byte Count = 0044*
1	05	01	*Source Port = 05 Dest. Port = 01*
2	00	05	*Source Node = 00 Dest. Node = 05*
3	80	80	*Source LSAP = 80 Dest. LSAP = 80*
4	01	08	*Repeat Count = 01 Commnad = 08 Perform Command*
5	00	00	*Reserved = 00 Reserved = 00*
6	00	00	*Sequence #, LSB = 00, MSB = 00*
7	00	00	*Sensor #, LSB = 00, MSB = 00*
8	00	00	*Reserved = 00 Operation = 00 Read, None to follow*
9	00	00	*Reserved = 00 Reserved = 00*
10	00	00	*Start Address, LSB = 00, MSB = 00*
11	14	00	*Length, LSB = 14, MSB = 00*
12	00	00	*Reserved Byte 0 = 00, 1 = 00*
13	00	00	*Reserved Byte 2 = 00, 3 = 00*
14	00	00	*Reserved Byte 4 = 00, 5 = 00*
15	00	00	*Reserved Byte 6 = 00, 7 = 00*
16	00	00	*Reserved Byte 8 = 00, 9 = 00*
17	00	00	*Reserved Byte 10 = 00, 11 = 00*
18	00	00	*Reserved Byte 12 = 00, 13 = 00*
19	00	00	*Reserved Byte 14 = 00, 15 = 00*
20	00	00	*Reserved Byte 16 = 00, 17 = 00*
21	00	00	*Reserved Byte 18 = 00, 19 = 00*

8. Enter PLC-5/15 Program (Continued)

PLC Command Files (continued)
Antenna Reset Command (Node 4 and Node 5)

The following command files contains Reset commands for each antenna. Each command resets the antenna to its default state. Enter the command data into the PLC-5/15 data table starting at address N7:440 for antenna Node 4 Reset and N7:450 for antenna Node 5 Reset. Use the BCD/Hex screen to enter the data. PLC data tables are shown on pages 5-34 to 5-36.

For complete details on the Reset command, refer to Chapter 7.

Node 4 Reset Antenna Command File

Word Offset	High Byte	Low Byte	
0	00	18	*Byte Count = 0018*
1	05	01	*Source Port = 05 Dest. Port = 01*
2	00	04	*Source Node = 00 Dest. Node = 04*
3	80	80	*Source LSAP = 80 Dest. LSAP = 80*
4	00	03	*Reserved = 00 Commnad = 03* Reset Antenna Command
5	00	00	*Reserved = 00 Reserved = 00*
6	00	00	*Sequence #, LSB = 00, MSB = 00*
7	00	00	*Sensor #, LSB = 00, MSB = 00*
8	00	00	*Reserved = 00 Reserved = 00*

Node 5 Reset Antenna Command File

Word Offset	High Byte	Low Byte	
0	00	18	*Byte Count = 0018*
1	05	01	*Source Port = 05 Dest. Port = 01*
2	00	05	*Source Node = 00 Dest. Node = 05*
3	80	80	*Source LSAP = 80 Dest. LSAP = 80*
4	00	03	*Reserved = 00 Commnad = 03* Reset Antenna Command
5	00	00	*Reserved = 00 Reserved = 00*
6	00	00	*Sequence #, LSB = 00, MSB = 00*
7	00	00	*Sensor #, LSB = 00, MSB = 00*
8	00	00	*Reserved = 00 Reserved = 00*

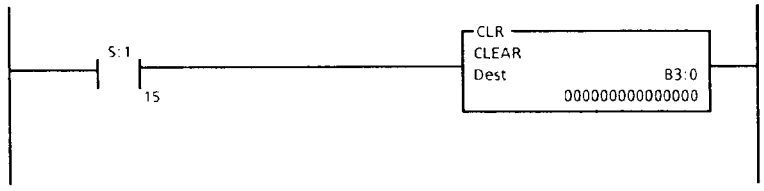
8. Enter PLC-5/15 Program (Continued) Ladder Logic Program

Now enter the following PLC-5/15 ladder logic program.

Rung 2:0

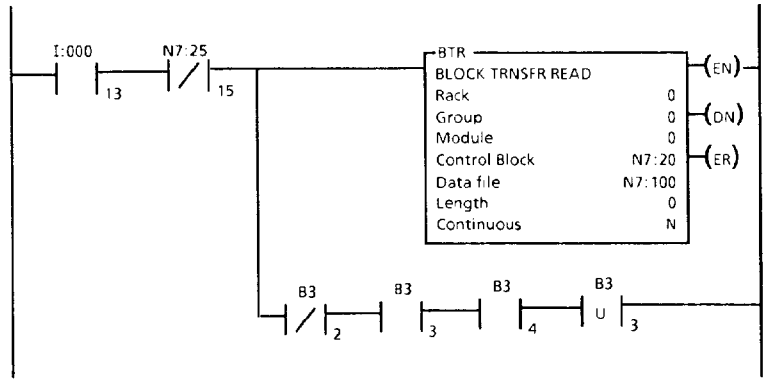
CLEAR PROGRAM CONTROL BITS ON FIRST SCAN ONLY. CONTROL BITS ARE:

- B3/1 WRITE REQUEST (CLEARED ON BTW RUNG TRUE)
- B3/2 WRITE DONE REQUEST (CLEARED ON BTW RUNG TRUE)
- B3/3 READ REQUEST (CLEARED ON CONDITIONAL BTR RUNG TRUE)
- B3/4 PROGRAM CYCLE IN PROCESS (CLEARED ON CONDITIONAL BTR DONE OR RESET TIMER DONE)
- B3/5 RESET TIMER REQUEST (CLEARED ON CONDITIONAL BTR DONE OR RESET TIMER DONE)



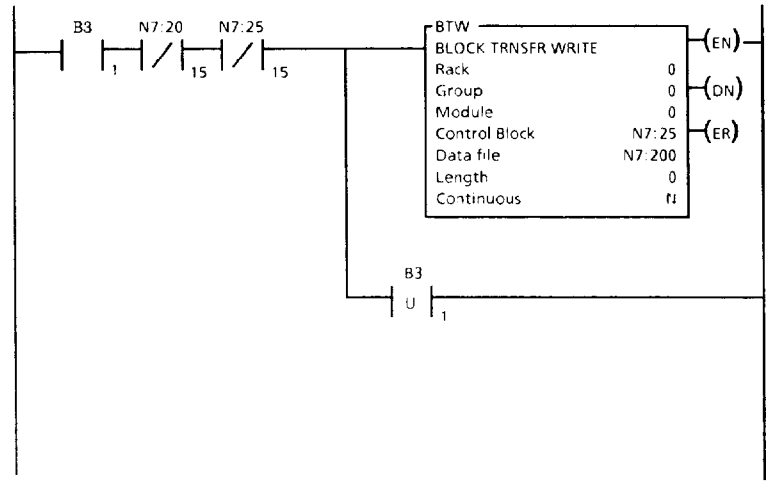
Rung 2:1

READ MODULE DATA ANYTIME DATA IS AVAILABLE (MODULE BRR BIT I:000/13 IS SET ON) EXCEPT WHEN BTW IS IN PROCESS. UNLATCH READ REQUEST (B3/3) ONLY IF WRITE DONE REQUEST (B3/2) IS CLEAR AND PROGRAM CYCLE IN PROGRESS (B3/4) IS SET.



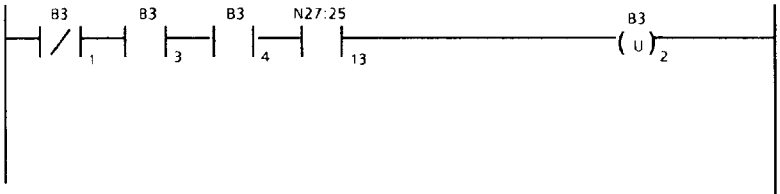
Rung 2:2

WRITE MODULE WHEN B3/1 IS SET (WRITE REQUEST). UNLATCH WRITE REQUEST (B3/1) ON RUNG TRUE.

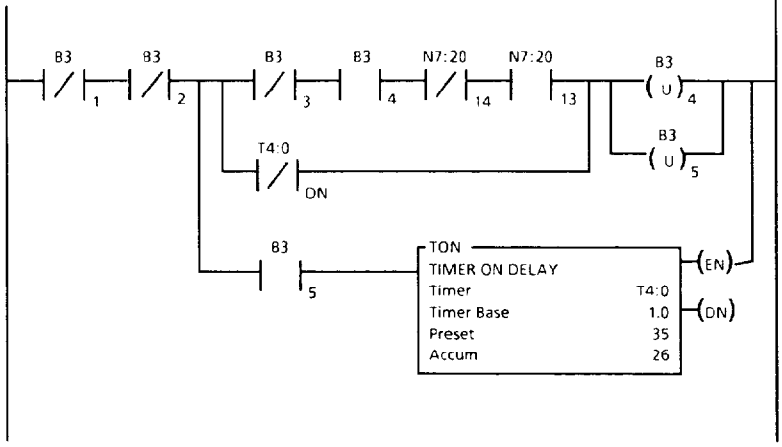


8. Enter PLC-5/15 Program (Continued) Ladder Logic Program (continued)

Rung 2:3
UNLATCH WRITE DONE REQUEST (B3/2) IF WRITE REQUEST (B3/1) IS CLEARED. READ REQUEST IS SET (B3/3). PROGRAM CYCLE IN PROGRESS (B3/4) AND BTW IS DONE.



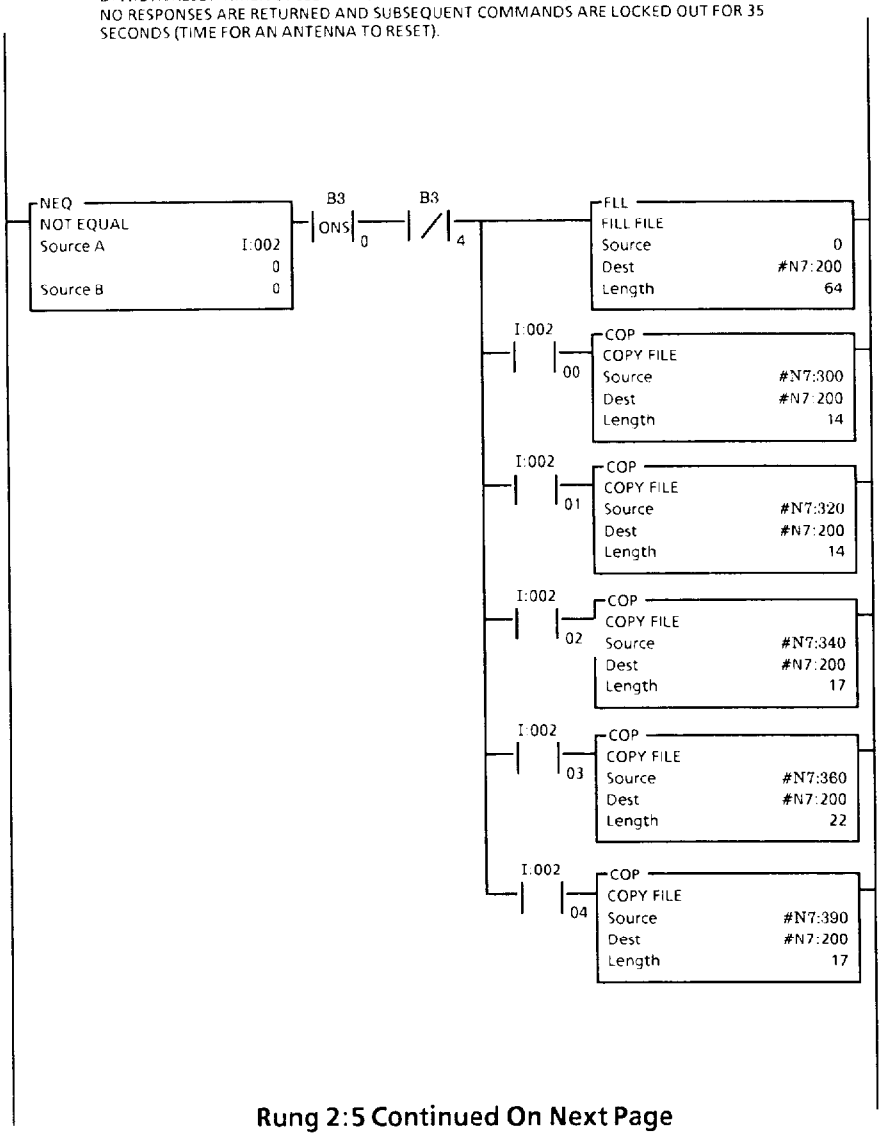
Rung 2:4
UNLATCH COMMAND PROGRAM CYCLE IN PROGRESS (B3/4) AND RESET TIMER REQUEST (B3/5). IF WRITE REQUEST (B3/1) IS CLEARED, WRITE DONE REQUEST (B3/2) IS CLEARED AND EITHER THE READ REQUEST IS CLEARED (B3/3) ALONG WITH WITH BTR DONE OR THE RESET TIMER REQUEST (B3/5) IS SET AND THE 35 SECOND TIMER HAS EXPIRED.



8. Enter PLC-5/15 Program (Continued) — Ladder Logic Program (continued)

Rung 2:5

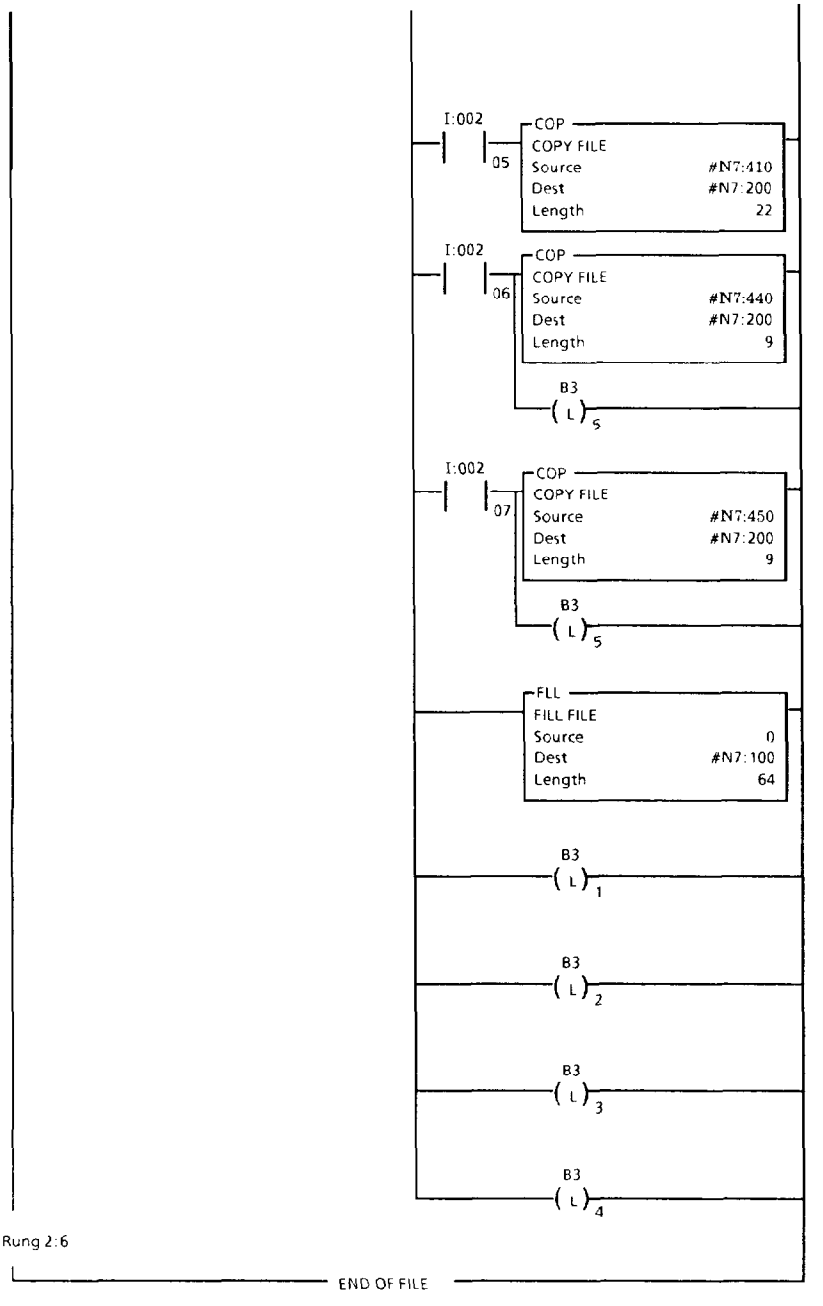
COMMAND SIM SWITCHES MUST RETURN TO OFF TO BE ABLE TO INITIATE ANOTHER COMMAND CYCLE. WHEN A COMMAND SWITCH IS DETECTED, THE BTW FILE IS CLEARED FOR VISUAL EXAMINATION. IN THIS EXAMPLE, THE COMMAND FILE IS COPIED TO THE BTW FILE. THE BTR FILE IS ALSO CLEARED FOR VISUAL EXAMINATION OF THE RESPONSE. THE BTW/BTR/RESET-TIMER/CYCLE IN PROCESS BITS ARE SET AS REQUIRED. FOR RESET COMMANDS, NO RESPONSES ARE RETURNED AND SUBSEQUENT COMMANDS ARE LOCKED OUT FOR 35 SECONDS (TIME FOR AN ANTENNA TO RESET).



Rung 2:5 Continued On Next Page

8. Enter PLC-5/15 Program (Continued) *Ladder Logic Program (continued)*

Rung 2:5 Continued From Previous Page



8. Enter PLC-5/15 Program (Continued)

PLC Data Table

Note: Addresses are in decimal and data is hexadecimal.

GOOD RESPONSE (POLLED BY FLEXIBLE INTERFACE MODULE) TO SET CONFIGURATION NODE 4 TO R/W 2K TAG COMMAND FILE

	0	1	2	3	4	5	6	7	8	9	
N7:100	0016	0105	0400	8080	0087	0000	0000	0000			
	byte	sprt	snod	slsap	rtnc	sis	seql	senl			←msb
	cnt	dprt	dnod	dlsap	resp	his	seqm	senm			←lsb

GOOD RESPONSE (POLLED BY FLEXIBLE INTERFACE MODULE) TO SET CONFIGURATION NODE 5 TO 20 CHAR PROG TAG COMMAND FILE

	0	1	2	3	4	5	6	7	8	9	
N7:100	0016	0105	0500	8080	0087	0000	0000	0000			
	byte	sprt	snod	slsap	rtnc	sis	seql	senl			←msb
	cnt	dprt	dnod	dlsap	resp	his	seqm	senm			←lsb

GOOD RESPONSE (POLLED BY FLEXIBLE INTERFACE MODULE) TO WRITE 10 BYTES ON NODE 4 TO R/W 2K TAG COMMAND FILE

	0	1	2	3	4	5	6	7	8	9	
N7:100	0034	0105	0400	8080	0088	0000	0000	0000	0201	0200	
	byte	sprt	snod	slsap	rpt	rsvd	seql	senl	rslt	atmp	←msb
	cnt	dprt	dnod	dlsap	cmd	rsvd	seqm	senm	wtop	rsvd	←lsb
N7:110	2000	0A00	0000	0000	0000	0000	0000				
	adrl	lenl	dat 0	dat 2	dat 4	dat 6	dat 8				←msb
	adrm	lenm	dat 1	dat 3	dat 5	dat 7	dat 9				←lsb

8. Enter PLC-5/15 Program (Continued)

PLC Data Table Continued

Note: Addresses are in decimal and data is hexadecimal.

GOOD RESPONSE (POLLED BY FLEXIBLE INTERFACE MODULE) TO WRITE 20 BYTES ON NODE 5 TO 20 CHAR PROGRAM TAG COMMAND FILE

	0	1	2	3	4	5	6	7	8	9	
N7:100	0044	0105	0500	8080	0088	0000	0000	0000	0201	0100	
	byte cnt	sprt dprt	snod dnod	slsap dlsap	rpt cmd	rsvd rsvd	seql seqm	senl senm	rslt wtop	atmp rsvd	←msb ←lsb
N7:110	0000	1400	0000	0000	0000	0000	0000	0000	0000	0000	
	adrl adrm	lenl lenm	dat 0 dat 1	dat 2 dat 3	dat 4 dat 5	dat 6 dat 7	dat 8 dat 9	dat a dat b	dat c dat d	dat e dat f	←msb ←lsb
N7:120	0000	0000									
	dat g dat h	dat i dat j									←msb ←lsb

GOOD RESPONSE (POLLED BY FLEXIBLE INTERFACE MODULE) TO READ 10 BYTES ON NODE 4 FROM R/W 2K TAG COMMAND FILE

	0	1	2	3	4	5	6	7	8	9	
N7:100	0034	0105	0400	8080	0088	0000	0000	0000	0200	0200	
	byte cnt	sprt dprt	snod dnod	slsap dlsap	rpt cmd	rsvd rsvd	seql seqm	senl senm	rslt rdop	atmp rsvd	←msb ←lsb
N7:110	2000	0A00	3039	3837	3635	3433	3231				
	adrl adrm	lenl lenm	dat 0 dat 1	dat 2 dat 3	dat 4 dat 5	dat 6 dat 7	dat 8 dat 9				←msb ←lsb

8. Enter PLC-5/15 Program (Continued)

PLC Data Table Continued

Note: Addresses are in decimal and data is hexadecimal.

GOOD RESPONSE (POLLED BY FLEXIBLE INTERFACE MODULE) TO
READ 20 BYTES ON NODE 5 FROM 20 CHAR PROGRAM TAG COMMAND FILE

	0	1	2	3	4	5	6	7	8	9	
N7:100	0044	0501	0005	8080	0088	0000	0000	0000	0200	0100	
	byte cnt	sprt cnt	snod cnt	slsap cnt	byte cnt	byte cnt	byte cnt	byte cnt	byte cnt	byte cnt	←msb ←lsb
N7:110	0000	1400	3031	3233	3435	3637	3839	4142	4344	4546	
	adrl adrm	lenl lenm	dat 0 dat 1	dat 2 dat 3	dat 4 dat 5	dat 6 dat 7	dat 8 dat 9	dat a dat b	dat c dat d	dat e dat f	←msb ←lsb
N7:120	4748	4950									
	dat g dat h	dat i dat j									←msb ←lsb

NO RESPONSE WILL BE GENERATED BY THE ANTENNA ON A
RESET NODE 4 OR NODE 5 ANTENNA COMMAND FILE

	0	1	2	3	4	5	6	7	8	9
N7:100	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000

Chapter 6 Antenna Configuration and Operation

Chapter Objectives

This chapter explains how to use Identification Protocol (IDP) commands to configure the antenna for different types of operation, and to perform tag transactions (read, write, and program tags). Separate sections tell how to set the antenna for:

- Using the object detect device and timeout settings.
- Operation with read/write tags.
- Read-only transactions with programmable tags.
- Programming programmable tags.

Set Antenna Configuration

Before performing any tag transactions with the antenna, you first define the antenna operations. You do this by sending the Set Sensor Configuration Command from the system host, which sets the antenna for:

Tag Type – Set according to the type of tag you are using.

Object Detect Mode – Enabled or disabled, according to whether or not you use an object detect device.

Transaction Timeout – Set according to requirements (**Note:** Minimum of 3 seconds for programming tags).

RF Field Strength Level – Set according to your application requirements (see Chapter 4).

Table 6.A summarizes the different types of antenna operations, as defined by the use of object detect, timeout, and command repeat count.

Note: The complete set of IDP commands is discussed in Chapter 7.

Setting the Object Detect Mode and Timeout

Object Detect – If you are using an object detect device, you must enable the object detect mode; the object detect active signal (switch closure) will trigger transaction attempts.

Timeout – You can set a specific timeout, or set the timeout to 0. Setting the timeout to 0 disables the timeout. The antenna will keep transmitting until successful.

If you set a specific timeout when you configure the antenna, the antenna keeps attempting communication until either the tag transaction is successful, or the timeout expires.

Setting the Object Detect Mode and Timeout (continued)

If a timeout is set, the object detect input, once initiated, is sustained active until either the transaction succeeds, or the timeout expires, *whether or not the object detect signal actually remains activated in the interim.*

Note: The object detect device must be active for a minimum of 10 milliseconds.

Table 6.A
Antenna Operating Modes

Object Detect Mode	Timeout Setting	Repeat Count	Operation
Object Detect Enabled	0	0-255①	After receiving transaction command, and the object detect input activates, the antenna will attempt transactions until successful, or until the object detect input deactivates. Type of failure (if any) is reported to host. Repeat count decrements. Sequence repeats when the object detect input activates again, unless repeat count has expired.
Object Detect Enabled	1-65,535 (x 100 milliseconds)	0-255①	After receiving transaction command, and the object detect input activates, the antenna will attempt transactions until successful, or until the timeout expires. Type of failure (if any) is reported to host. Repeat count decrements. Sequence repeats when the object detect activates again (after timeout expires), unless repeat count expired.
Object Detect Disabled	0	0-255①	After receiving transaction command, the antenna will immediately attempt transactions until successful. No failures are reported to host. Repeat count decrements. Sequence repeats as soon as the transaction succeeds, unless repeat count has expired.
Object Detect Disabled	1-65,535 (x 100 milliseconds)	0-255①	After receiving transaction command, the antenna will immediately attempt transactions until successful, or until the timeout expires. Type of failure (if any) is reported to host. Repeat count decrements. Sequence repeats as soon as the timeout expires, unless repeat count has expired.

① Repeat count of 0 selects unlimited repeat (i.e., repeat until another command is received by the antenna).

IDP Perform Command

To read or write to the tags or program tags when using DH-485 protocol, you use the IDP "Perform" command. The Perform command includes a data field in which you place a "Sensor Program." The Sensor Program contains the actual coding of the read and/or write command descriptors.

You can code a single tag read or write transaction, or chain a number of tag reads and/or writes to be executed within each tag transaction.

Repeat Counts

The IDP Perform command includes a repeat count field which allows you to repeat the given command a specified or an unlimited number of times. If you use a command repeat count of **0**, the command is repeated without limit (until another IDP command is received).

We recommend that you use the object detect device and a transaction timeout when using a repeat count. This allows a more positive control over transactions, and helps curb the possibility of repeating a transaction with the same tag.

Object Detect with Timeout and Repeat Count – If you use a repeat count with object detect and a timeout, a transaction is repeated when: 1) the previous transaction succeeds or times out, 2) the object detect input goes inactive, and 3) the object detect input goes active again (after the previous transaction succeeds or times out).

Start Address and Length Fields

The transaction commands each include a start address and a length field. These fields allow you to specify which tag memory locations you will access, and how much data you will transfer (see Table 6.B for tag capabilities).

Data Limitations – The Sensor Program portion of the Perform command can be 112 bytes long.

Table 6.B
Tag Types and Descriptions

Tag Types	Features Summary
Read/Write①	Data can be read from or written to tag online during system operation • Any binary pattern, including all ASCII characters, can be stored. • Addressable 2k or 8k bytes of RAM memory (depending on model). • First 32 bytes are reserved, and are read only • Capable of selective, highly defined memory storage, interactive read/write exchanges, and tag data modification online.
Programmable①	Online operations with this tag normally are read only. • Depending on how the antenna is configured, the tag memory is: – 6-digit (using digits 0-9 only), or – 20 characters ②, or – 40 characters ② • Tag EEPROM memory requires initial programming (offline programming, while tag is stationary, is recommended).

①**Note:** See Pub. No 2750-2.9, "Bulletin 2750-Radio Frequency Tags," for more tag information.

②**Note:** Characters available are a subset of ASCII: 0-9, upper case A-Z, also &, *, –, and space.

Programmable Tag Transactions

To use the programmable tags for operation with your antenna, you first set the antenna configuration. You can program the programmable tags only if you use a 2750-AHP or -AHPR antenna. You can program tags in 6-digit, 20-character, or 40-character format. You can read programmable tags with any model antenna.

Example Programming Configuration

Assume that you are using programmable tags, and a Catalog No. 2750-AHP antenna. You want to program 40-character tags, so you will configure the antenna for 40-character programmable tag type.

When you program tags, the antenna-to-tag distance must be 5-7 inches.

Note: The tags should be stationary during programming). Assume the object detect is used. The RF level setting does not matter; the antenna transmits at a fixed level when configured for programming.

Note: Set at least a 3-second timeout for programming tags.

In order to program tags as described above, you could set the antenna configuration as follows:

Tag Type – 40-character programmable (Word 05 = 00 22)

Object Detect Mode – Enabled (Word 07 = 00 01)

Timeout – 3 seconds (Word 08 = 00 1E)

RF Field Strength Level – Low (Word 09 = 00 02)

Refer to Table 7.G for coding of sensor parameters

Example Set Sensor Command					
Command Field(s)	Word Offset		(Byte Offset)		(Byte Offset)
Command – (reserved)	00	07	(00)	00	(01)
(reserved)	01	00	(02)	00	(03)
Seq. No. (MSB-LSB)	02	00	(04)	01	(05)
Sensor No.	03	00	(06)	00	(07)
Reserved	04	00	(08)	00	(09)
Tag Type	05	00	(0A)	22	(0B)
(Read Only)	06	00	(0C)	00	(0D)
Object Detect Enable	07	00	(0E)	01	(0F)
Transaction Timeout	08	00	(10)	1E	(11)
RF Field Strength	09	00	(12)	02	(13)

For response format, refer to Set Sensor Configuration command in Chapter 7.

Example Programming (Write) Command

Shown below is a Perform (write) command which can be can be used for programming programmable tags. The example command calls for the antenna to write 40 bytes of data to the tag, starting at address 0000.

Note: You must program all 40 bytes of tag memory, unless you set the antenna for a programmable, addressable tag type (see "Addressable Programming" below).

With the antenna set for a 3-second timeout, object detect enabled, the antenna attempts to complete the transaction when the object detect signal goes active.

Sensor Program Write Descriptor ↓

Example Write Sensor Command					
Command Field(s)	Word Offset		(Byte Offset)		(Byte Offset)
Command – Repeat Ct.	**00**	08	(00)	01	(01)
(reserved)	**01**	00	(02)	00	(03)
Seq No. (MSB-LSB)	**02**	00	(04)	02	(05)
Sensor No.	**03**	00	(06)	00	(07)
Write with no more (08) Reserved (09)	**04**	01	(08)	00	(09)
Reserved	**05**	00	(0A)	00	(0B)
Start Addr. (MSB-LSB)	**06**	00	(0C)	00	(0D)
Length (MSB-LSB)	**07**	00	(0E)	28	(0F)
Data	**08**	41	(10)	11	(11)
Data	**09**	42	(12)	12	(13)
...	...	↓	...		...
...	...		...		...
Data	**1B**	19	(36)	19	(37)

Addressable Programming

To program programmable tags and access specific tag memory locations, you must configure the antenna tag type for programmable addressable (6-digit, 20-character, or 40-character).

Note: Before you can a program tag with the antenna configured for the "programmable, addressable" tag type, you must first program all of the tag's memory (6-digit, or 20- or 40-character) with the antenna configured for "programmable" tag type.

Example Read Only Configuration

Assume that you are using programmable tags, and a Catalog No. 2750-AHD Short Range Antenna. You want to execute a repeating tag read command

Note: You can read programmable tags with any model antenna).

Assume the antenna-to-tag distance is 8 inches (61 cm). The tags are stationary during transactions, stopping for 10 seconds in the antenna signal range. You are using an object detect device.

In order to operate the antenna as described above, you must configure antenna for 6-digit, 20-character, or 40-character read only. Set the following configuration parameters as a starting point (the timeout and RF level settings might require adjustment as you test the operation):

Tag Type – Read Only (Word Offset 05 = 00 00)

Object Detect Mode – Enabled (Word Offset 07 = 00 01)

Timeout – 3 seconds (Word Offset 08 = 00 1E)

RF Field Strength Level – High (Word Offset 09 = 00 05)

The diagram below is a Set Sensor Configuration command which could be used for a setting the above parameters:

Refer to Table 7.G for coding of sensor parameters

Example Set Sensor Configuration Command					
Command Field(s)	Word Offset		(Byte Offset)		(Byte Offset)
Command – (reserved)	00	07	(00)	00	(01)
(reserved)	01	00	(02)	00	(03)
Seq. No. (MSB-LSB)	02	00	(04)	03	(05)
Sensor No.	03	00	(06)	00	(07)
Reserved	04	00	(08)	00	(09)
Tag Type	05	00	(0A)	00	(0B)
(Read Only)	06	00	(0C)	00	(0D)
Object Detect Enable	07	00	(0E)	01	(0F)
Transaction Timeout	08	00	(10)	1E	(11)
RF Field Strength	09	00	(12)	05	(13)

For response format, refer to Set Sensor Configuration command in Chapter 7.

Example Repeating Read Command

Shown below is a Perform (read) command, which includes a repeat count set to 00 (unlimited repeats).

The command calls for the antenna to read 40 bytes of data. The read starting address is 0000 Hex. The length is 0028 Hex (40 decimal). The read descriptor includes a 40-byte data buffer.

When you send the repeating read command (with the antenna configured for object detect enabled and a 3-second timeout) the antenna will transmit when the object detect goes active. The antenna will continue to transmit until successful, or until the timeout expires. The antenna will repeat the read when the object detect goes active again.

Sensor Program Read Descriptor ↓

Example Repeat Read Command					
Command Field(s)	Word Offset		(Byte Offset)		(Byte Offset)
Command – Repeat Ct.	**00**	08	(00)	00	(01)
(reserved)	**01**	00	(02)	00	(03)
Seq No. (MSB-LSB)	**02**	00	(04)	04	(05)
Sensor No.	**03**	00	(06)	00	(07)
Read with no more (08) Reserved (09)	**04**	00	(08)	00	(09)
Reserved	**05**	00	(0A)	00	(0B)
Start Addr. (MSB-LSB)	**06**	00	(0C)	00	(0D)
Length (MSB-LSB)	**07**	00	(0E)	28	(0F)
Data	**08**	20	(10)	20	(11)
Data	**09**	20	(12)	20	(13)
. . .	. . .		. . .		. . .
. . .	. . .		. . .		. . .
Data	**1B**	20	(36)	20	(37)

For response format, refer to Perform Command description in Chapter 7.

Read/Write Tag Transaction

To use the read/write tags for operation with your antenna, you first set the antenna configuration for your operation.

Example Configuration

Assume that you are using read/write tags, and a Catalog No. 2750-AH antenna with an object detect device.

Assume the antenna-to-tag distance is 24 inches (61 cm). The tags are moving during transactions, at a speed of 12 inches (30 cm) per second. This means the tags are in the antenna signal range for about 2 seconds.

In order to operate the antenna in the conditions described above, you might set the following configuration parameters as a starting point (the timeout and RF level settings might require adjustment as you test the operation):

Tag Type – 2K read/write tag (Word Offset 05 = 00 10)

Object Detect Mode – Enabled (Word Offset 07 = 00 01)

Timeout* – 2 seconds (Word Offset 08 = 00 14)

RF Field Strength Level – High (Word Offset 09 = 00 05)

***Note:** Set timeout to accommodate transaction. This may require some trial and error. Large data transfers, or chained transactions, require a longer timeout than a single transaction with 30 bytes of data, for example.

Refer to Table 7.G for coding of sensor parameters

Example Set Sensor Configuration Command					
Command Field(s)	Word Offset		(Byte Offset)		(Byte Offset)
(reserved) – Command	00	07	(00)	00	(01)
(reserved)	01	00	(02)	00	(03)
Seq. No. (MSB-LSB)	02	00	(04)	05	(05)
Sensor No.	03	00	(06)	00	(07)
Reserved	04	00	(08)	00	(09)
Tag Type	05	00	(0A)	10	(0B)
(Read Only)	06	00	(0C)	00	(0D)
Object Detect Enable	07	00	(0E)	01	(0F)
Transaction Timeout	08	00	(10)	14	(11)
RF Field Strength	09	00	(12)	05	(13)

Example Perform (Read/Write) Command

Shown below is an example Perform (read/write) command. This command includes a tag read chained to a tag write, which would normally be used only with a read/write tag.

The command calls for the antenna to first read 4 bytes of data. The read starting address is 0020 Hex (32 decimal). The read descriptor includes a 4-byte data buffer. The antenna would then write 4 bytes of data to the tag, starting at address 0022 (34 decimal).

With the antenna set for a 2-second timeout, object detect enabled, the antenna attempts to complete the transaction when the object detect signal goes active.

	Example Read/Write Sensor Program					
	Command Field(s)	Word Offset		(Byte Offset)		(Byte Offset)
	Command – Repeat Ct.	00	08	(00)	01	(01)
	(reserved)	01	00	(02)	00	(03)
	Seq No. (MSB-LSB)	02	00	(04)	06	(05)
	Sensor No.	03	00	(06)	00	(07)
Sensor #1 Program Start of 1st descriptor (Read with more to follow)	Read with more (08) Reserved (09)	04	80	(08)	00	(09)
	Reserved	05	00	(0A)	00	(0B)
	Start Addr. (MSB-LSB)	06	00	(0C)	20	(0D)
	Length (MSB-LSB)	07	00	(0E)	04	(0F)
	Data	08	20	(10)	20	(11)
	Data	09	20	(12)	20	(13)
Sensor #2 Program Start of 2nd descriptor (Write with none to follow)	Write, none to follow (14) Reserved (15)	0A	01	(14)	00	(15)
	Reserved	0B	00	(16)	00	(17)
	Start Addr (MSB-LSB)	0C	00	(18)	22	(19)
	Length (MSB-LSB)	0D	00	(1A)	04	(1B)
	Data	0E	41	(1C)	42	(1D)
	Data	0F	43	(1E)	44	(1F)

For response format, refer to Perform Command description in Chapter 7.

Chapter 7 IDP (Antenna) Commands

Chapter Objectives

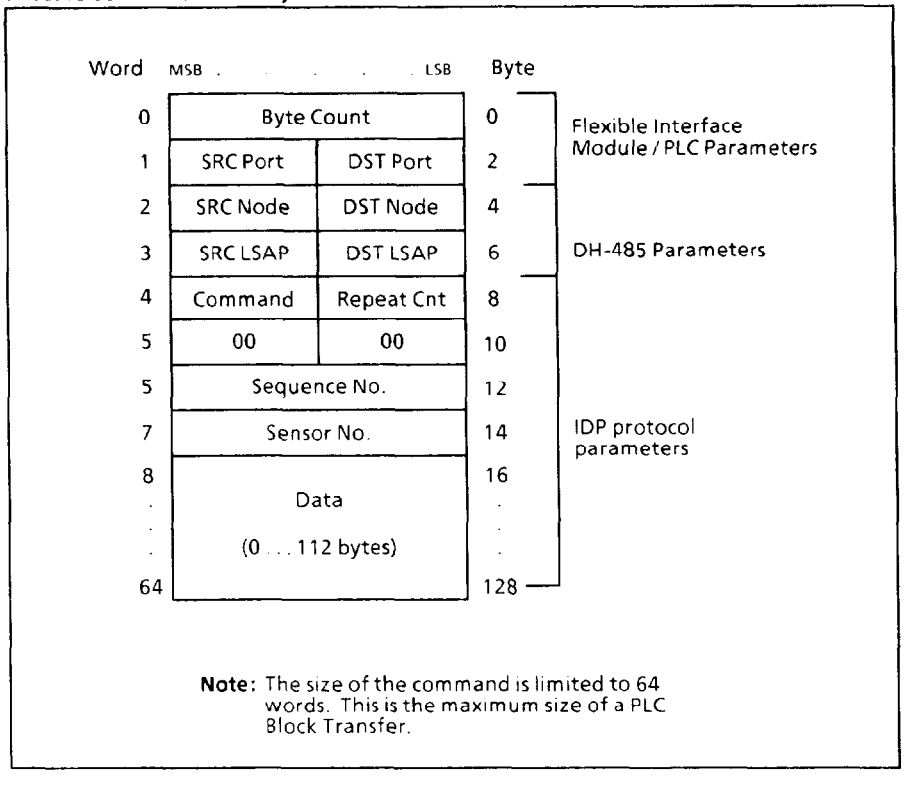
This chapter defines the commands that can be used to operate the antenna when using DH-485 protocol. This chapter includes:

- Description of the general format of commands
- Description of the general format of antenna response
- Example coding, and discussion of command parameters
- Example antenna responses to commands

Command Format

Appendix C provides an overview of the DH-485 protocol. Most of the DH-485 network functions are handled automatically by the Flexible Interface Module. Figure 7.1 shows the format of commands when communicating with an antenna on a DH-485 network using the Flexible Interface Module.

Figure 7.1
Antenna Command Format (From PLC / Flexible Interface Module Host)



Note: The size of the command is limited to 64 words. This is the maximum size of a PLC Block Transfer.

Command Format (Continued)

A host device on the network must provide the following data with each antenna command:

- Byte Count (PLCs Only) This Binary Coded Decimal (BCD) indicates the number of bytes in the message, including word 0. Port 5 of the Flexible Interface Module (used for PLC communications) adds the byte count to the message before sending it to another port. The Flexible Interface Module removes the byte count before block transferring the message to the PLC.

- Source Port # (SRC Port) The number of the Flexible Interface Module port (0 to 7) sending the message.

- Destination Port # (DST Port) The number of the Flexible Interface Module port (0 to 7) receiving the message.

- Source Node # The node (0 to 31) in the network which sends the message.

- Destination Node # The node (0 to 31) in the network which receives the message.

- Source LSAP (SRC LSAP) The communication address of the node sending a message. The 2750-AH antenna uses the LSAP of 128 (80 hex) to read, write or configure tag data. Use LSAP 00 for network communications diagnostics.

- Destination LSAP (DST LSAP) The communication address of the node receiving a message. The 2750-AH antenna uses the LSAP of 128 (80 hex) to read, write or configure tag data. Use LSAP 00 for network communications diagnostics.

- Repeat Count The number of times the command is to be performed.

- Command (CMD) The IDP command function to be performed. Set this byte to the appropriate hex code for the desired command. See Table 7.A.

- Sequence No. A unique number (supplied by host) that associates an antenna reply with a command. The antenna will return the same value with the reply message. Make sure that the high byte of this word is set to 00. The high byte is used by the Flexible Interface Module.

Command Format (Continued)

- Sensor No. The high and low bytes are always set to 00.
- Data The data field is used with the following commands:

  Echo command (Data to be echoed)

  Perform command – Read and/or write descriptors. Use the Perform command to cause the antenna to perform tag reads and writes, by using that command's data field to code read and write transaction descriptors. See "Perform Command" and also "Sensor Program" descriptions in this Chapter.

  Set / Get configuration commands – Refer to individual commands.

Table 7.A
Command Codes and Descriptions

Command	Code	Command Description
Echo Interface	01	This command sends data to the antenna's host interface processor; data is returned to the host unchanged. Use this command to test the communications link between host and antenna.
Echo Sensor	11	This command sends data to the antenna's sensor processor; data is returned to the host unchanged. Use this command to check the antenna internal RAM swapping.
Interface and Sensor Diagnostics	02	This command causes the antenna to run diagnostics on both the host interface and sensor processors. Returned results are coded in six data bytes.
Sensor Diagnostics	12	This command causes the antenna to run diagnostics on the sensor processor. Results are returned in a two byte data field.
Reset	03	This command causes the antenna host interface and sensor processors to reinitialize and start running again with default configuration. Sensor defaults to settings from the last sensor configuration command.
Get Interface Configuration	04	This command will get the current communication settings of the host interface. Configuration returned in the data field includes DIP switch settings.
Get Sensor Configuration	06	This command causes antenna to return its working parameters, such as tag type, object detect, timeout. Some parameters (revision number and technology type) are reserved, read only.
Set Sensor Configuration	07	This command sets the antenna working parameters. Read only fields are ignored and should be set to zero.
Perform	08	This command will cause the antenna to execute the sensor program sent to it as many times as is indicated by the repeat count. Sensor program includes tag read and/or write command descriptor(s).

Antenna Response Format

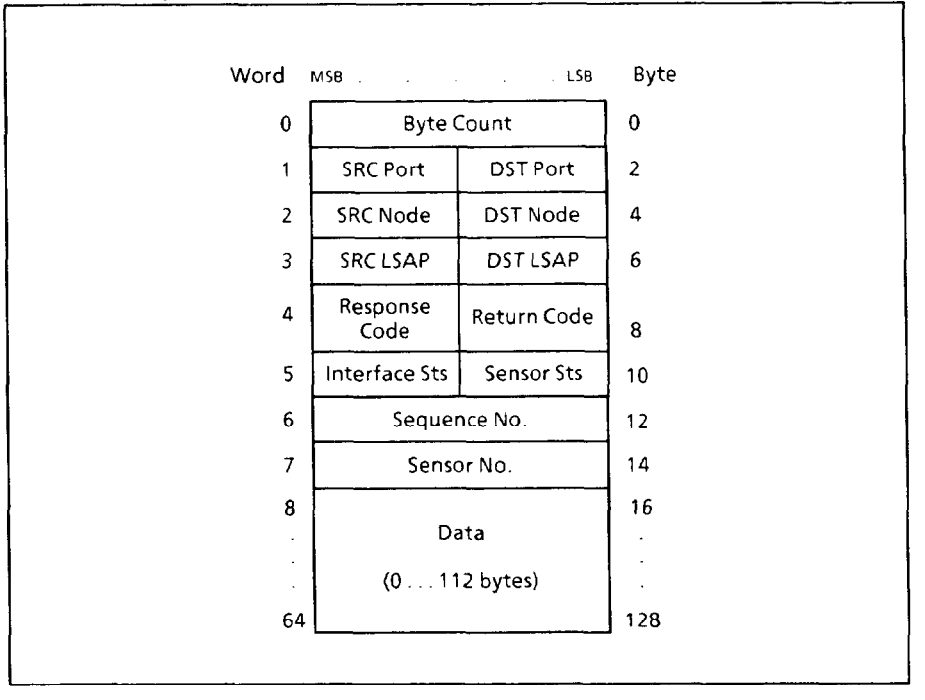
The antenna returns a response to each command from the host (*except* the Reset command). Response information is contained in the first 8 bytes of the antenna's IDP response.

Responses to the following commands return a data field:

- Echo (data returned).
- Perform Read or Write Tag Transactions
- Get Interface Configuration (configuration returned).
- Get Sensor Configuration (configuration returned).
- Diagnostics

Refer to the Figure 7.2 and response field descriptions which follow:

Figure 7.2
Antenna Response Format



Response Code – The response returns the same command code as the antenna command code, except 80 Hex is added. For example: If the command code is 01, the response code will be 81; if the command is 12, the response code is 92, etc.

Antenna Response Format (Continued)

Return Code – This field contains a code indicating the success or failure status of a command execution. Table 7.B, lists return codes.

Table 7.B
Antenna Command Return Codes

Bit Set	Meaning
0	Invalid Command
1	Command execution unsuccessful
2	Command format error. See Note 2, below
3	Never returned set
4	Never returned set
5	Never returned set
6	Never returned set
7	Error (set if any other bits are set)
No bits set	Success

Note 1: More than one bit can be set.
Note 2: A command format error is returned for the following:

- "Length" in Sensor Program not equal to actual length of Data field
- Length of command header and data (if any) not as expected by antenna (header information or data lost)

Host Interface Status – This field contains a code indicating host interface processor status. See Table 7.C.

Table 7.C
Host Interface Status

Bit Set	Meaning
0	Internal interface fault
1	Host communications failure
2	Never returned set
3	Never returned set
4	Never returned set
5	Never returned set
6	Never returned set
7	Never returned set
No bits set	Normal status

Note: More than one bit can be set.

Antenna Response Format (Continued)

Sensor Interface Status – This field contains a code indicating status of the sensor interface processor. Table 7.D lists status codes.

Table 7.D
Sensor Interface Status

Bit Set	Meaning
0	Internal sensor fault
1	Interface to sensor communications failure
2	The data buffer of the sensor has overflowed
3	Never returned set
4	Never returned set
5	Never returned set
6	Never returned set
7	Never returned set
No bits set	Normal status

Note: More than one bit can be set.

Sequence Number – Unchanged (same as in command).

Sensor Number – 00 00 (same as in command).

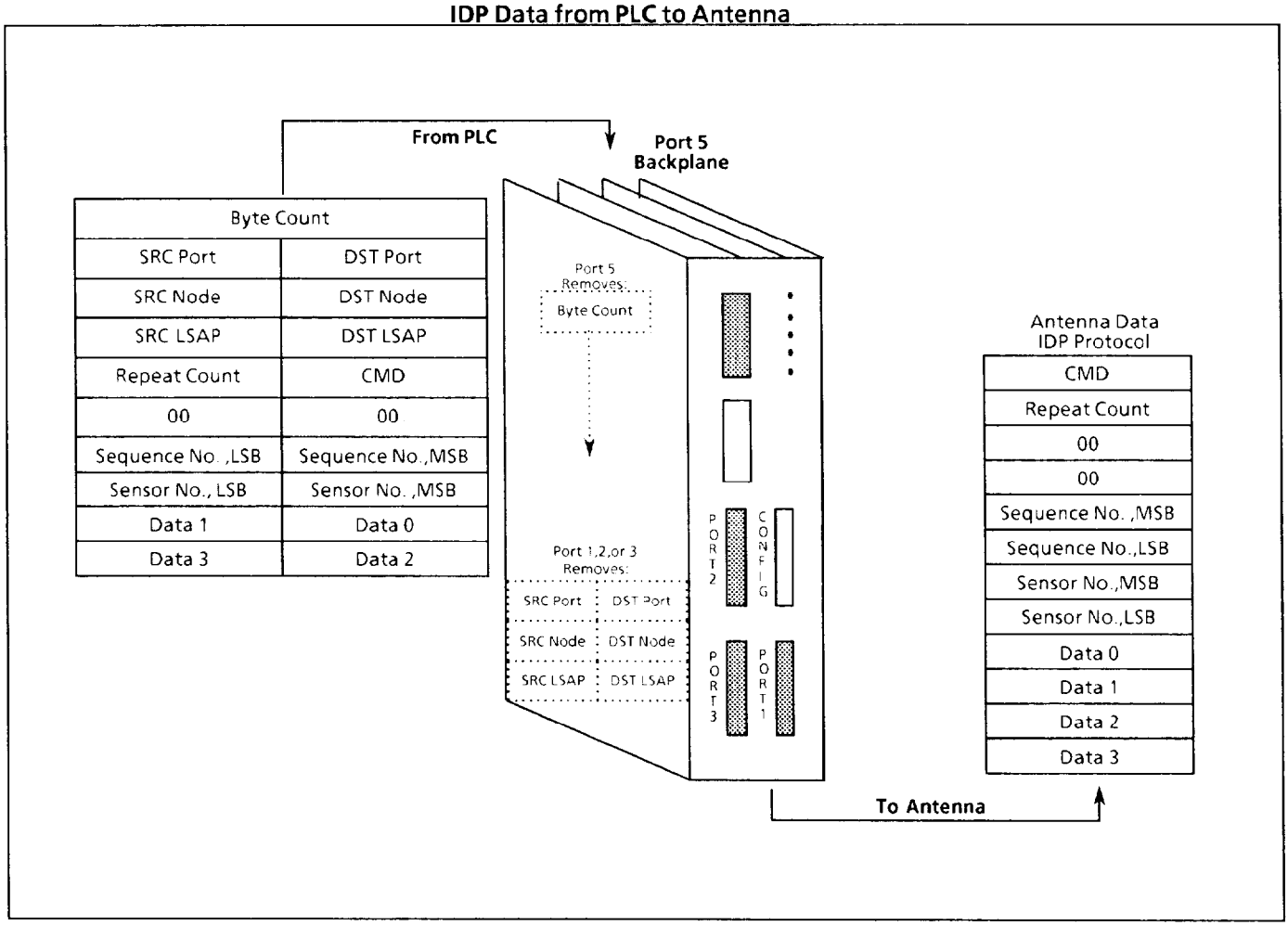
Data Field – The data field is padded by the Interface Processor so that an even number of bytes are sent in responses. Data is dependent of type of command. See Perform, Echo, and Get Configuration Commands for response data descriptions.

Applying IDP Commands (Continued)

Figures 7.3 and 7.4 illustrate how the Flexible Interface Module handles data as it is transferred between devices on a DH-485 network:

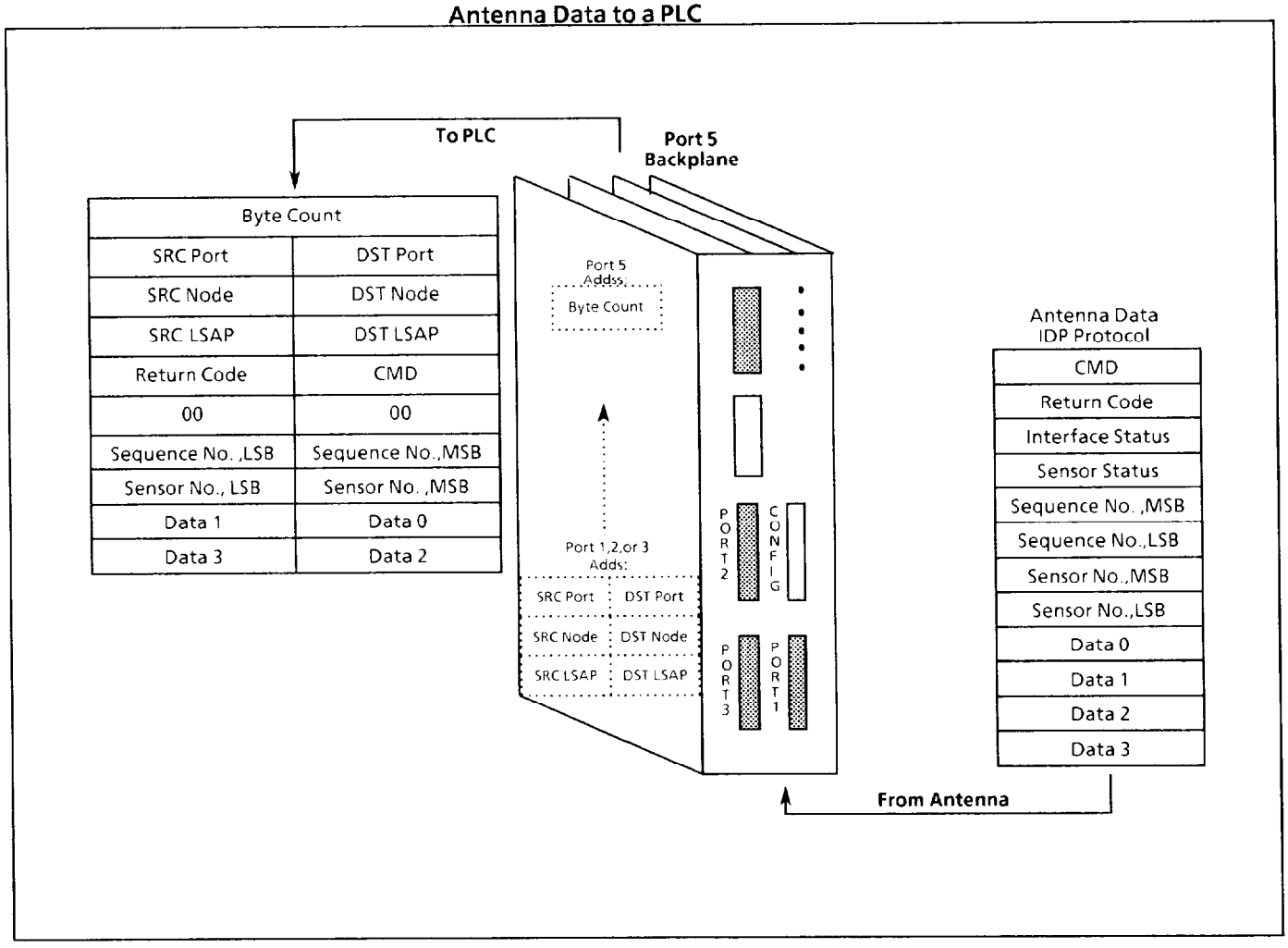
- Figure 7.3 shows how an IDP command is transferred from a PLC to an antenna on the DH-485 network.
- Figure 7.4 shows how IDP data is transferred from an antenna to a PLC on the DH-485 network.

Figure 7.3
IDP Data from PLC to Antenna



Applying IDP Commands (Continued)

Figure 7.4
Antenna Data to a PLC



Interface Processor Echo Command

Use this command to test the communications link between the host and the antenna. You can include any ASCII characters or Hex values in the data field; the antenna response returns the data bytes unchanged.

Antenna Command Format:

Command Format				
Word Offset	Command Field	(Byte Offset)	Command Field	(Byte Offset)
00	01	(00)	00	(01)
01	00	(02)	00	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)
04	Data*	(08)	Data*	(09)

*Enter any number of data bytes, up to 112 bytes

Antenna Response Format:

Response Format				
Word Offset	Response Field	(Byte Offset)	Response Field	(Byte Offset)
00	81	(00)	Return Code*	(01)
01	Host Interface Status*	(02)	Sensor Interface Status*	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)
04	Data (same as sent)	(08)	Data (same as sent)	(09)

*These Hex values must be converted to binary, and decoded. Refer to Tables 7.B, 7.C, and/or 7.D to decode.

Sensor Processor Echo Command

Sensor Processor Echo will take any data passed to the sensor interface and return it to the sending host unchanged. This command is used for testing the RAM swapping capability of the antenna processors.

Antenna Command Format:

Command Format				
Word Offset	Command Field	(Byte Offset)	Command Field	(Byte Offset)
00	11	(00)	00	(01)
01	00	(02)	00	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)
04	Data*	(06)	Data*	(07)

*Enter any number of data bytes, up to 112 bytes

Antenna Response Format:

Response Format				
Word Offset	Response Field	(Byte Offset)	Response Field	(Byte Offset)
00	91	(00)	Return Code*	(01)
01	Host Interface Status*	(02)	Sensor Interface Status*	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)
04	Data (same as sent)	(08)	Data (same as sent)	(09)

*These Hex values must be converted to binary, and decoded. Refer to Tables 7.B, 7.C, and/or 7.D to decode.

Interface and Sensor Diagnostics Command

Host and Sensor Interface diagnostics causes the antenna to run diagnostics on both the Host and Sensor Processors. This command requires no data field.

Note: The Interface and Sensor diagnostics command causes slot time out and other errors on the network master because the antenna is not responding to polling packets when diagnostics are being performed.

Antenna Command Format:

Command Format				
Word Offset	Command Field	(Byte Offset)	Command Field	(Byte Offset)
00	02	(00)	00	(01)
01	00	(02)	00	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)

Note: The DIP switch configuration settings are examined during this command, the Antenna Reset command, and during power-up.

Antenna Response Format:

Response Format				
Word Offset	Response Field	(Byte Offset)	Response Field	(Byte Offset)
00	82	(00)	Return Code*	(01)
01	Host Interface Status*	(02)	Sensor Interface Status*	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)
04	Host Status Code (see Table 7.E)	(08)	00	(09)
05	Sensor Status Code (see Table 7.F)	(0A)	00	(0B)
06	Bad IDP Commands **	(0C)	Messages with Framing Errors ***	(0D)

* These Hex values must be converted to binary, and decoded. Refer to Tables 7.B, 7.C, and/or 7.D to decode.

** Format of IDP command was invalid, not processed.

*** Parity errors detected during reception of message. The message was discarded.

Interface and Sensor Diagnostics Command (Continued)

Table 7.E
Host Interface Diagnostics Status

Bit Set	Meaning
0	RAM test failed
1	EPROM test failed
2	Always 0
3	Always 0
4	Sensor communications test failed
5	Always 0
6	Always 0
7	Always 0

Note: More than one bit can be set.

Table 7.F
Sensor Interface Diagnostics Status

Bit Set	Meaning
0	RAM test failed
1	EPROM test failed
2	EEPROM test failed
3	R/O decoder RAM test failed
4	R/O decoder ROM test failed
5	R/O decoder test failed
6	Always 0
7	Always 0

Note: More than one bit can be set.

Sensor Diagnostics Command

Sensor interface diagnostics causes the antenna to run diagnostics on Sensor Interface. This command requires no data field be included. Results are returned in a two-byte data field.

Antenna Command Format:

Command Format				
Word Offset	Command Field	(Byte Offset)	Command Field	(Byte Offset)
00	12	(00)	00	(01)
01	00	(02)	00	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)

Antenna Response Format:

Response Format				
Word Offset	Response Field	(Byte Offset)	Response Field	(Byte Offset)
00	92	(00)	Return Code*	(01)
01	Host Interface Status*	(02)	Sensor Interface Status*	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)
04	Sensor Status Code (see Table 7.F)	(08)	00	(09)

*These Hex values must be converted to binary, and decoded. Refer to Tables 7.B, 7.C, and/or 7.D to decode.

Antenna Reset

This command causes the Host and Sensor Interfaces to hard reset, and reinitialize.* Sensor Interface default settings will remain at the most recent Sensor Configuration Command configuration.

Note: The Antenna Reset command causes slot time out and other errors on the network master because the antenna is not responding to polling packets when the reset is being performed.

> ***Note:** The antenna does not return any response to this command.

Command Format				
Word Offset	Command Field	(Byte Offset)	Command Field	(Byte Offset)
00	03	(00)	00	(01)
01	00	(02)	00	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)

Get Interface Configuration Command

This command will get the current working parameters of the antenna's host communication interface. Parameters include baud rate and network node number.

Antenna Command Format:

Command Format				
Word Offset	Command Field	(Byte Offset)	Command Field	(Byte Offset)
00	04	(00)	00	(01)
01	00	(02)	00	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)

Antenna Response Format:

Response Format				
Word Offset	Response Field	(Byte Offset)	Response Field	(Byte Offset)
00	84	(00)	Return Code*	(01)
01	Host Interface Status*	(02)	Sensor Interface Status*	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)
04	DIP Switch Settings**	(08)	00	(09)
05	Firmware Series No.	(0A)	Firmware Revision No.	(0B)

* These Hex values must be converted to binary, and decoded. Refer to Tables 7.B, 7.C, and/or 7.D to decode.

** Refer to Figure 4.7.

Note: These parameters are set and not configurable:

- 8 bits/character
- Even parity
- 1 stop bit
- 1 start bit

The default baud rate depends on the baud rate DIP switch setting.

Get Sensor Configuration Command

This command causes the antenna to return its sensor interface configuration. This information includes tag type, object detect mode, timeout, and RF Field strength (see Table 7.G). This command includes no data field. The response includes a 12-byte data field with the configuration settings (beginning with Word Offset 04).

Antenna Command Format:

Command Format				
Word Offset	Command Field	(Byte Offset)	Command Field	(Byte Offset)
00	06	(00)	00	(01)
01	00	(02)	00	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)

Antenna Response Format (see Table 7.G):

Response Format				
Word Offset	Response Field	(Byte Offset)	Response Field	(Byte Offset)
00	86	(00)	Return Code*	(01)
01	Host Interface Status*	(02)	Sensor Interface Status*	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)
04	Reserved	(08)	Reserved	(09)
05	00	(0A)	Tag Type	(0B)
06	Firmware Revision No.	(0C)	Firmware Revision Level	(0D)
07	00	(0E)	Object Detect Enable	(0F)
08	Transaction timeout (MSB)	(10)	Transaction Timeout (LSB)	(11)
09	00	(12)	RF Field Strength	(13)

* These Hex values must be converted to binary, and decoded. Refer to Tables 7.B, 7.C, and/or 7.D to decode.

Get Sensor Configuration Command (Continued)

Table 7.G
Sensor Configuration Data

Byte Offset	Function	Hex Value	Meaning
00- 01	Read Only	--	Reserved (field ignored in command)
02	Not Used	00	--
03	Tag Type	00	6 digit, 20 or 40 character R/O
		10	2K R/W
		11	8K R/W
		20	6-digit programmable ②
		21	20-character programmable ②
		22	40-character programmable ②
		40	6-digit programmable, addressable ②③
		41	20-character programmable, addressable ②③
		42	40-character programmable, addressable ②③
04	Firmware Rev.	--	(Read Only) Firmware Revision Number
05	Firmware Rev.	--	(Read Only) Firmware Revision Level
06	Not Used	00	--
07	Object Detect Mode	00	Disabled
		01	Enabled
08-09 (MSB-LSB)	Transaction Timeout	00 00 – FF FF	In 100 millisecond units (setting of 00 00 disables timeout)
0A	Not Used	00	--
0B	RF Field Strength	00	Disabled
		01	Minimum ④
		02	Low ④
		03	Medium ④
		04	High ⑤
		05	Maximum ⑤

① Read only; parameters for this field are ignored in the Set Configuration Command.
② Setting is valid only for programming antennas, including Cat. Nos. 2750-AHP, and 2750-AHPR.
③ In order to use this setting, tag memory must first be fully programmed in the corresponding programmable mode (i.e., 6-digit, or 20- or 40-character programmable mode).
④ With the 2750-AHD Antenna, setting a Hex Value of 01, 02, or 03 will all equal Low.
⑤ With the 2750-AHD Antenna, setting a Hex Value of 04 or 05 will both equal High.

Set Sensor Configuration Command

This command causes a sensor to start using the parameters passed to it in the data field. With this command, you define the antenna operation for type of tag, object detect enable, timeout, and RF field strength.

To set these parameters, you must know which of these settings is appropriate for your operation. For information regarding the RF level, object detect, and timeout settings, refer to Chapter 6.

Antenna Command Format (see Table 7.G):

Command Format				
Word Offset	Command Field	(Byte Offset)	Command Field	(Byte Offset)
00	07	(00)	00	(01)
01	00	(02)	00	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)
04	00	(08)	00	(09)
05	00	(0A)	Tag Type	(0B)
06	00	(0C)	00	(0D)
07	00	(0E)	Object Detect Enable	(0F)
08	Transaction timeout (MSB)	(10)	Transaction timeout (LSB)	(11)
09	00	(12)	RF Field Strength	(13)

Antenna Response Format:

Response Format				
Word Offset	Response Field	(Byte Offset)	Response Field	(Byte Offset)
00	87	(00)	Return Code*	(01)
01	Host Interface Status*	(02)	Sensor Interface Status*	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)

* These Hex values must be converted to binary, and decoded. Refer to Tables 7.B, 7.C, and/or 7.D to decode.

Example Set Sensor Configuration Command

The diagram below shows the coding for a typical Set Sensor Configuration command.

According to the command in the example below, and referring to Table 7.G, the antenna would be configured for:

- 2K read/write tag (Byte Offset 0B = 10)
- Object detect mode enabled (Byte Offset 0F = 01)
- Timeout 4000 milliseconds or 4 seconds (Byte Offset 11 = 28)
- RF level set to low (Byte Offset 13 = 02)

Example Command					
Command Field(s)	Word Offset		(Byte Offset)		(Byte Offset)
Command – (reserved)	**00**	07	(00)	00	(01)
Reserved	**01**	00	(02)	00	(03)
Seq. No. (MSB-LSB)	**02**	12	(04)	34	(05)
Sensor No.	**03**	00	(06)	00	(07)
Reserved	**04**	00	(08)	00	(09)
Tag Type	**05**	00	(0A)	10	(0B)
(Read Only)	**06**	00	(0C)	00	(0D)
Object Detect Enable	**07**	00	(0E)	01	(0F)
Transaction Timeout	**08**	00	(10)	28	(11)
RF Field Strength	**09**	00	(12)	02	(13)

Perform Command

The command will cause the antenna to execute the sensor program descriptors (defined in the command data field) as many times as is indicated in the repeat count field. The results are returned to the host for each repeat of the Perform command, for each command descriptor in the Perform command data field.

Options on how the data is formatted are based on the interface configuration options. See Table 7.G.

Antenna Command Format:

Command Format				
Word Offset	Command Field	(Byte Offset)	Command Field	(Byte Offset)
00	08	(00)	Repeat Count ②③	(01)
01	00	(02)	00	(03)
02	Sequence No. (MSB)④	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)
04	Data ①	(08)	Data ①	(09)

① Up to 112 bytes; see Sensor Programs, next page.

② Repeat = 00 Repeat Perform forever with same Data field (until another command is received).
01–FF Number of times sensor program will be repeated with same Data field.

③ Number of responses will be same as number of repeats.

④ MSB of perform commands must be 00 to work with the Flexible Interface Module.

Antenna Response Format:

Response Format				
Word Offset	Response Field	(Byte Offset)	Response Field	(Byte Offset)
00	88	(00)	Return Code①	(01)
01	Host Interface Status①	(02)	Sensor Interface Status①	(03)
02	Sequence No. (MSB)	(04)	Sequence No. (LSB)	(05)
03	00	(06)	00	(07)
04	Data ②	(08)	Data ②	(09)

① Several values are possible. These Hex values must be converted to binary, and decoded. Refer to Tables 7.B, 7.C, and/or 7.D to decode.

② Responses to Sensor Program; next page.

Sensor Program

The Sensor Program defines the transaction to be performed by the antenna with the RF tags. You place the Sensor Program in the data field of the Perform command. In general, the Sensor Program consists of the read and/or write command descriptor(s).

You can chain multiple read and/or write descriptors in the Sensor Program. The number of these is limited only in that the total descriptor coding and data bytes must not exceed 112 bytes (see "Operation" below for chaining information).

Refer to Table 7.H for coding of fields.

Command Descriptor Format				
Word Offset		(Byte Offset)		(Byte Offset)
00	Operation	(00)	00	(01)
01	00	(02)	00	(03)
02	Start Address (MSB)	(04)	Start Address (LSB)	(05)
03	Length (MSB)	(06)	Length (LSB)	(07)
04	Data	(08)	Data	(09)
...		...		...
...		...		...
...		...		...
...	Data	...	Data	...

Command Descriptor Fields

The command descriptor fields of the Sensor Program are described below:

Operation – Set to the appropriate hex code:

Hex codes – 00 Read Command (None to follow)

01 Write Command (None to follow)

80 Read Command (More to follow)

81 Write Command (More to follow)

For a single transaction, use 00 (read) or 01 (write). To chain transactions, use 80 (read) or 81 (write). In the last descriptor in your sensor program, always use 00 (read) or 01 (write) to indicate "none to follow."

Command Descriptor Fields (continued)

Start Address – Set the byte offset (in hex) in tag memory of the first sequential memory location to be accessed. For programming tags, set to 0, unless antenna is configured for programmable addressable tag (see "Tag Type," Table 7.G, for tag type settings). For read/write tags, first 32 bytes are reserved, read only. The start address must be an even number.

Length – Set the number of bytes (in hex) to be read from or written to a tag, beginning at the Start Address (must match the number of bytes in data field). Length value (plus start address) must not exceed tag memory capacity (no. of bytes). The length must be an even number.

> **Note:** The length value must match the number of bytes included in the command data field.

Data Field – The data field is used in write commands, and in read commands.

Data Bytes – With programmable tags, You can use a limited set of ASCII* characters, depending on the antenna configuration (see Table 6.B for descriptions of tag memory, and "Tag Type" in Table 7.G).

The number of data bytes included must match the number indicated in the Length field, or the command will fail.

***Note:** See Appendix D for ASCII conversions.

Data Buffers in a Read Descriptor – When coding a read descriptor, you must send data (ASCII 0 or space character is recommended) in the data field as a data buffer. The number of data bytes in this buffer must be the same number of bytes as the Length value. The tag data is then returned in this buffer in the response.

Sensor Program Response Fields

The fields of the Sensor Program response are described below (see also Table 7.H for response decoding):

Response Descriptor Format				
Word Offset		(Byte Offset)		(Byte Offset)
00	Operation	(00)	Result Code	(01)
01	00	(02)	Attempts	(03)
02	Start Address (MSB)	(04)	Start Address (LSB)	(05)
03	Length (MSB)	(06)	Length (LSB)	(07)
04	Data	(08)	Data	(09)
...		...		...
...		...		...
...		...		...
...	Data	...	Data	...

Operation – Returned as sent in command descriptor.

Result Code – This indicates either success (02 Hex), or the type of failure of the tag transaction.

Attempts – This indicates number of attempts made by the antenna to complete the transaction. The maximum value is 255; after this, the antenna stops counting.

Note: A consistently high number of attempts (10 or more) over several responses may indicate some kind of problem with the RF link between antenna and tags. Check component set-up, tag positioning and orientation, object detect positioning, or antenna RF level (See Chapter 8 for troubleshooting guidelines).

Start Address – Returned as sent in command descriptor.

Length – Returned as sent in command descriptor.

Data Field – The data field contains tag data for a response to a read command. The data field is zero filled in response to write commands.

Sensor Program Response Fields (continued)

Table 7.H
Sensor Program Descriptor Codes

Byte Offset	Function	Hex Value	Meaning
00	Operation	00	Read, no more descriptors to follow
		01	Write, no more descriptors to follow
		80	Read, more descriptors to follow
		81	Write, more descriptors to follow
01	Result Code (only in responses)	01	Operation failed. Possible causes – no tag present, tag is failing, antenna is failing, RF power is too low, or RF signal is obstructed.
		02	Operation successful.
		03	Tag detected, operation failed. Possible causes – RF power level is inadequate, RF signal is obstructed, tag is too far from antenna, or capture time is inadequate.
		09	Operation invalid, operation failed. Possible causes – tag type configuration setting is invalid for type of transaction, invalid operation code, data type not correct for tag type.
		0B	Tag detected, operation invalid, operation failed. Possible cause – antenna configured for programmable addressable tag, and tag has not been previously programmed.
02	Not Used	00	
03	Attempts (only in responses)	00 – FF	Attempts made by antenna to perform the tag transaction, until tag transaction succeeds or fails. Returned in responses only. Attempts beyond 255 (FF Hex) not counted.
04 – 05 (MSB – LSB)	Start Address	xx – xx (User Defined)	Sets the byte offset (in Hex), or address, in tag memory of the first sequential memory location to be read from or written to.
06 – 07 (MSB – LSB)	Length	xx – xx (User Defined)	Sets the number (in hex) of successive bytes of tag memory accessed (must match number of bytes in data field, and must be EVEN number.
08 – 09	Data	xx – xx (User Defined)	Data read from or written to the tag, or data used for buffer in tag read command.

Example Perform Command

Shown below is a typical Perform Command. This command includes a tag read chained to a tag write, which would normally be used only with a read/write tag.

The command calls for the antenna to first read 4 bytes of data, starting at address 0020 Hex (32 decimal). Next the antenna writes 4 bytes of data to the tag, starting at address 0022 (34 decimal).

	Example Command Format					
	Command Field(s)	Word Offset		(Byte Offset)		(Byte Offset)
	Command – Repeat Ct.	**00**	08	(00)	01	(01)
	(reserved)	**01**	00	(02)	00	(03)
	Seq No. (MSB-LSB)	**02**	00	(04)	12	(05)
	Sensor No.	**03**	00	(06)	00	(07)
Start of 1st descriptor (**Read** with more to follow)	Read with more (08) Reserved (09)	**04**	80	(08)	00	(09)
	Reserved	**05**	00	(0A)	00	(0B)
	Start Addr. (MSB-LSB)	**06**	00	(0C)	20	(0D)
	Length (MSB-LSB)	**07**	00	(0E)	04	(0F)
	Data (ASCII spaces)	**08**	20	(10)	20	(11)
	Data (ASCII spaces)	**09**	20	(12)	20	(13)
Start of 2nd descriptor (**Write** with none to follow)	Write, none to follow (14) Reserved (15)	**0A**	01	(14)	00	(15)
	Reserved	**0B**	00	(16)	00	(17)
	Start Addr (MSB-LSB)	**0C**	00	(18)	22	(19)
	Length (MSB-LSB)	**0D**	00	(1A)	04	(1B)
	Data (ASCII A, B)	**0E**	41	(1C)	42	(1D)
	Data (ASCII C, D)	**0F**	43	(1E)	44	(1F)

Example Perform Response

Shown below is a typical response to the "Example Perform Command". The antenna responses includes ASCII characters 1, 2, 3, and 4, which were read from the tag (see word offset 08 and 09).

	Example Response Format					
	Command Field(s)	Word Offset		(Byte Offset)		(Byte Offset)
	Command – Repeat Ct.	**00**	88	(00)	01	(01)
	Sensor – Interface STS	**01**	00	(02)	00	(03)
	Seq No. (MSB-LSB)	**02**	00	(04)	12	(05)
	Sensor No.	**03**	00	(06)	00	(07)
Start of 1st descriptor (**Read** with more to follow)	Read – Results (success)	**04**	80	(08)	02	(09)
	Attempts (5 made)	**05**	00	(0A)	05	(0B)
	Start Addr. (MSB-LSB)	**06**	00	(0C)	20	(0D)
	Length (MSB-LSB)	**07**	00	(0E)	04	(0F)
	Data (ASCII 1, 2)	**08**	31	(10)	32	(11)
	Data (ASCII 3, 4)	**09**	33	(12)	34	(13)
Start of 2nd descriptor (**Write** with none to follow)	Write – Results (success)	**0A**	01	(14)	02	(15)
	Attempts (3 made)	**0B**	00	(16)	03	(17)
	Start Addr. (MSB-LSB)	**0C**	00	(18)	22	(19)
	Length (MSB-LSB)	**0D**	00	(1A)	04	(1B)
	Length (MSB-LSB)	**0E**	00	(1C)	00	(1D)
	Length (MSB-LSB)	**0F**	00	(1E)	00	(1F)

Chapter 8 Troubleshooting

Chapter Objectives

This chapter describes maintenance and caution procedures that should be followed when using the Allen-Bradley 2750-AH series antennas. Information on defining the LED functions and a troubleshooting chart of corrective actions also appear in this chapter.

Preventive Maintenance

The antenna does not require regular maintenance. You should periodically inspect the device to see that no metallic obstructions have settled on the antenna cover over time.

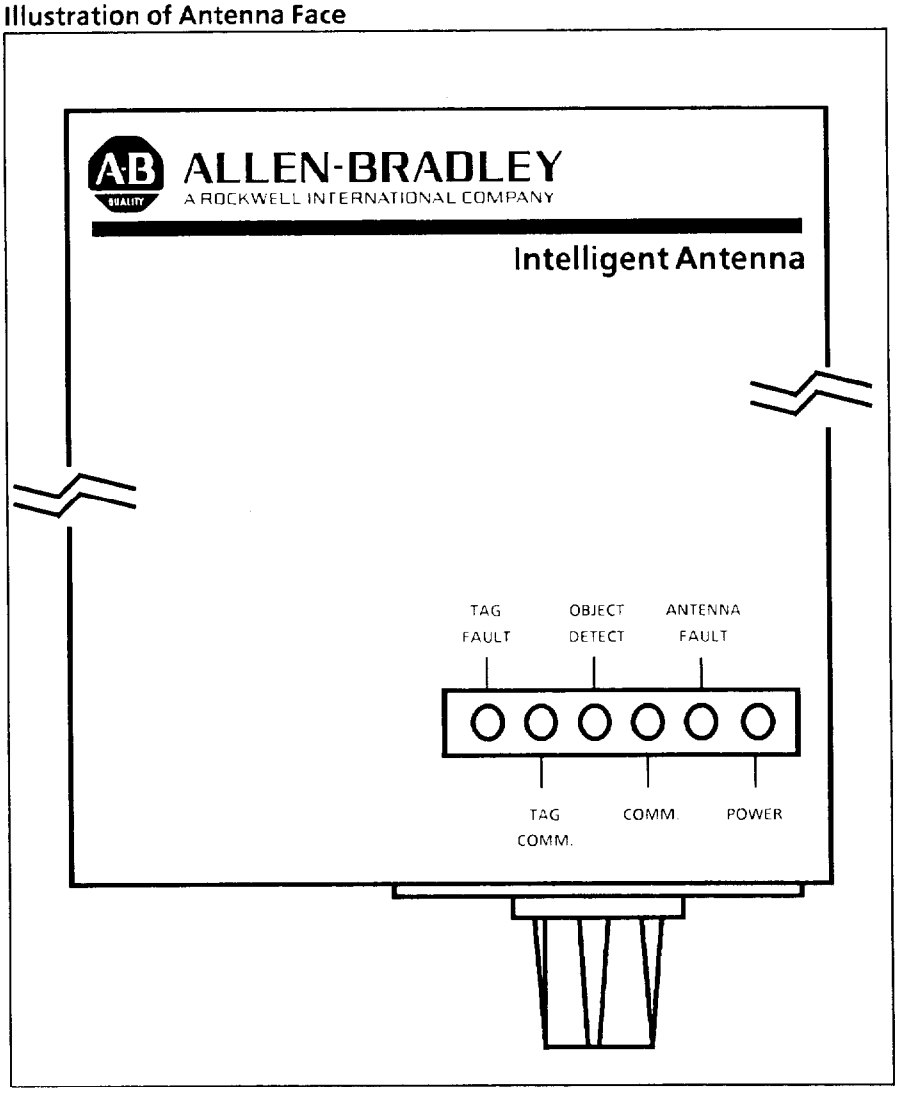
IMPORTANT: All Intelligent Antennas have a warranty seal on the base of the antenna. This consists of a white filler in one of the base plate screws. Removal of this screw and material will void the warranty.

CAUTION: Maintenance personnel carrying tags may activate unintended operations in certain antenna modes.

Diagnostic LED Indicators

Diagnostic LEDs on the device should be viewed regularly under normal operation. The LEDs are located on the face of the antenna. Figure 8.1 illustrates the face of the antenna, and the location of the LEDs.

Figure 8.1
Illustration of Antenna Face



Diagnostic LED Indicators (continued)

All the LEDs have a specified condition. Knowing the normal state will aid in troubleshooting the device if necessary.

During the antenna power-up and initialization sequence (approx. 30 sec.), the LEDs will demonstrate a patterned flashing operation.

The LEDs and their functions are described in Table 8.A.

Table 8.A
LED Functions

LED Label	LED Color	Normal Status	LED Status Explanation	
			On	Off
Tag Fault	RED	Normally off.	Last read or write operation failed or timed out.	No error detected.
Tag Comm.	YELLOW	Normal status is off. Changes state as tags pass.	Data is being transferred to / from a tag.	No transmission in progress.
Object Detect	YELLOW	Normal status is off.* Changes states when O.D.closes physically or logically.	Object detect is active, or object detect mode is disabled.	Object detect is not active.
Comm.	GREEN	Normally on.	Controller communication is OK.	Controller communication is lost.
Antenna Fault	RED	Normally off.	Flashing: Intelligent Antenna fault.	Normal operations underway.
Power	GREEN	Normally on.	Power is applied.	No power applied.

*Note: If the object detect mode is disabled, this LED will always remain on.

Fuse Replacement

The main input power fuse for the antenna is located under the access cover (refer to Figure 4.2). If this fuse is blown, no LED indicators will illuminate when power is applied to the antenna. To replace the fuse:

1. Disconnect power from the antenna.
2. Try to determine reason for fuse blowing and correct problem.
3. Remove wiring access cover.
4. Remove and install new fuse 3 Amp "Reg Blo" 125V such as: *Bussman AGX-3* or *Littlefuse 362003*

Troubleshooting

Should the antenna not function properly, the LEDs can be interpreted to indicate what corrective action should be taken. Consult Table 8.B for troubleshooting information.

Table 8.B
Troubleshooting Guide

Condition	Corrective Actions
Power LED off. No LEDs lit.	• Check plug-in connector. • Check power supply connections. • Check power supply fuse. • Check antenna fuse. • Check other devices connected to the supply. • Replace supply. • Replace antenna.
Tag Fault LED ON/Steady	• Reset antenna. • Check Return Codes, Sensor Status, and Interface Status in Command response. See Tables 7.B, 7.C, 7.D. • Use Get Sensor Configuration Command and check configuration of tag type. • Use Get Sensor Configuration Command and check O.D. mode and timeout. • Try a different tag. • Replace the antenna.
Tag Comm. LED does not come on when tag passes	• Check O.D. mode. • Check O.D. timeout. • Check antenna power level. • Check O.D. switch / wiring / jumper pins. • Check power LED. • Replace antenna.
Object Detect status LED off when tag passes	• Check power LED. • Check O.D. configuration • Check wiring / jumper pins. • Check O.D. alignment. • Check O.D. switch / replace. • Reset antenna. • Replace the antenna.
Comm. status off	• Check power LED. • Check baud rate. • Check wiring connections. • Check plug-in connector(s). • Check Host terminal connections. • Check jumper pins. • Check setup of network host. • Reset antenna (Power OFF – Power ON). • Replace antenna.
Antenna Fault LED flashing	• Send diagnostics command and record results code included in response for interpretation. • Reset device. • Reconfigure and reset. • Replace antenna.

System Fault Isolation

In order to isolate and pinpoint a system performance fault, begin by recognizing and considering the basic areas of the RFID system performance, as listed below.

Antenna Hardware:

- Antenna Power
- Antenna hardware configuration (connections and jumpers)
- Antenna LED indicators
- Connection to object detect (if used)

RFID Site:

- Signal Obstructions
- Reflective Surfaces

Host Communication:

- Host-to-antenna physical link
- Host to antenna message integrity

Host Message Content:

- Antenna configuration
- Antenna commands

Component Set-up:

- Tag-to-tag Spacing
- Antenna-to-tag Spacing
- Antenna-to-tag Orientation
- Object Detect connection
- Object Detect placement

Operation Definition (antenna configuration):

- Object Detect Enable
- Timeout
- Tag type
- RF level

Component Performance:

- Tag Performance
- Object Detect Performance

Defining the Problem

To begin to define a system performance problem, define the point at which system failure occurs. Depending on the nature of the problem, you can check the various basic system performance areas as appropriate. Some checks for each area are listed in the rest of this chapter.

Note: Check first for obvious damage or failure of components, for interruption of communication , and obstruction of RF signals.

Host Communication

Do you have communication? Check your host communication, both the physical link, and the actual communications:

DH-485 network failure:

- Refer to Software Diagnostics in the Flexible Interface Module User's Manual (Catalog No. 2760-ND002).

Host-to-antenna physical link failure:

- Send an Echo command (see Chapter 7) to the antenna, and check the antenna Comm. LED.

If Comm. LED doesn't go ON, recheck the connections. See Chapter 5 for connecting the host to antenna, and check your host communication parameters and make sure they match the antenna.

If Comm. LED does go ON, check the integrity of your connection or communication link.

Host to antenna communication integrity:

- Send an Echo command to the antenna, and check the data returned, and the return code (see Chapter 7).
- If the return code indicates failure, check to see the nature of the failure.

Host Message Content

If you have successful communication, check the content of your messages, and the return codes in the responses.

- Send a Get Sensor Configuration command to the antenna. Check the configuration values against those in the tables (see Chapter 7) for:

  -Tag type

  -Object Detect Mode

  -Timeout setting

  -RF level

- Send an antenna transaction (read or write) command (see Chapter 7). What results do you get? Check the return codes. Check the Tag Comm. LED.

Chapter 9 RF Tag Hardware and Installation

Chapter Objectives

Read this chapter for guidance in the installing, storing, and disposing of the Allen-Bradley radio frequency (RF) tags. Separate sections describe:

- Tag testing
- Tag mounting dimensions
- Tag mounting recommendations
- Tag storage recommendations
- Tag disposal requirements (for **read/write** tags only).

Chapter Overview

The Allen-Bradley RF tags operate in conjunction with the Allen-Bradley Intelligent Antennas in an RFID system (see Chapter 2 for general RFID operation information). There are two basic types of RF tags, **programmable** tags and **read/write** tags, and there are different models of each type (see Figure 9.1).

This chapter addresses the physical specifications of the two tag types for installation, storage, and handling purposes.

The tag specifications are further described in Appendix A and in Table 6.B. For more tag information, refer also to Publication 2750-2.9, "Product Data –Bulletin 2750 Radio Frequency Tags."

Chapter Prerequisites

The following information must be available in order to install the tags:

- Tag mounting location on item or pallet
- Tag mounting orientation

For guidelines in planning the tag mounting location and orientation, see Chapter 3.

Tag Testing

You may wish to test tag functionality prior to installing the tags. For this purpose, we recommend use of the Allen-Bradley Tag Test Stand (Catalog No. 2750-TTS). Consult your local Allen-Bradley representative for more information regarding this device.

Tag Installation Guidelines

To install the RF tag, consult with your system designer for required tag position and orientation. Tag installation recommendations differ, depending on the type of tag.

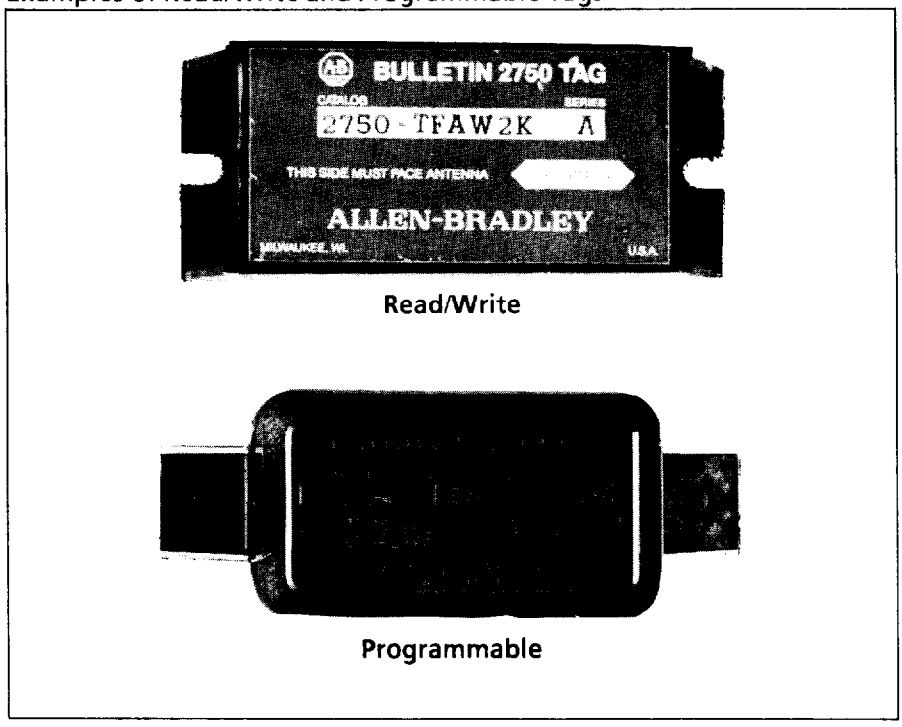
Refer to the guidelines in this section for each tag type. Refer to Figures 9.2, 9.3, and 9.4 for tag dimensions.

Programmable Tags

For mounting the programmable tags other than the Flatpak tags, follow these guidelines (see Figure 9.2):

- Use of non-metal screws (nylon) is suggested.
- Screw size: Up to $\frac{1}{4}$ – 20
- Use only non-metal flat washers
- Torque to 10 inch/pounds maximum to avoid breakage.

Figure 9.1
Examples of Read/write and Programmable Tags

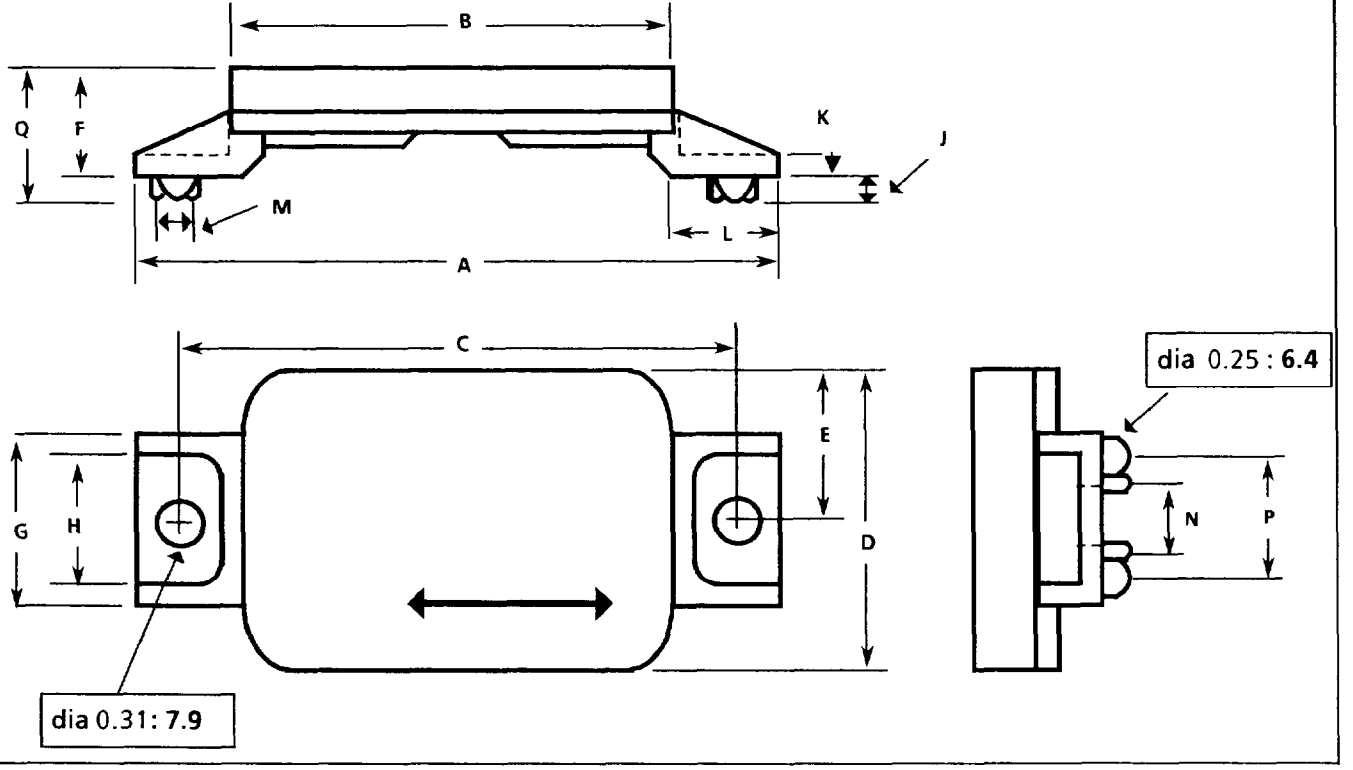


99-349-2

Programmable Tags
(continued)

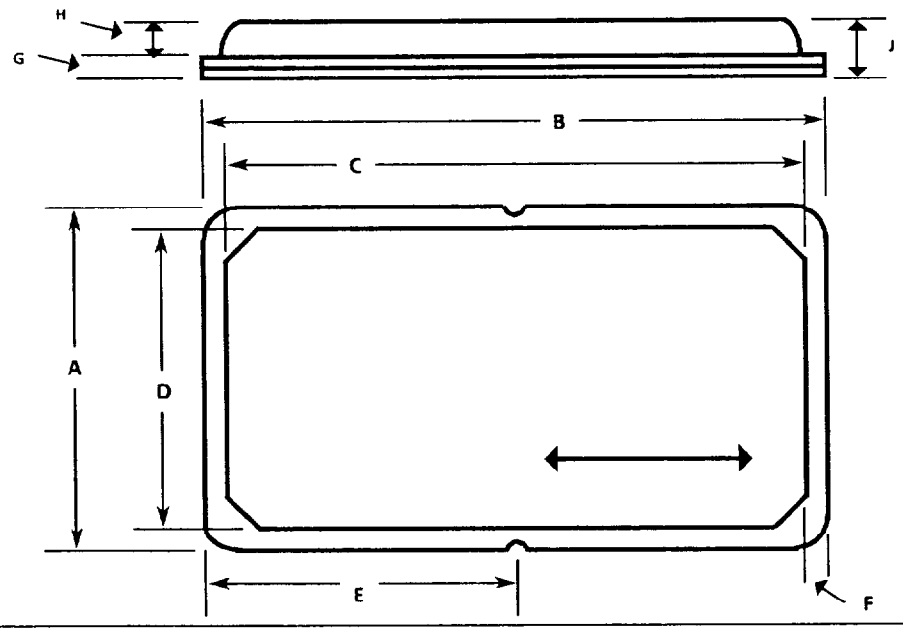
Figure 9.2
Mounting Dimensions, Programmable Tags, Including Catalog Nos. 2750-TAU40, -TSHU40

Dimensions inches : mm			Dimensions (cont.'d) inches : mm			Dimensions (cont.'d) inches : mm		
A	5.2	**: 132**	F	0.82	**: 20.8**	L	0.82	**: 20.8**
B	3.37	**: 85.6**	G	1.1	**: 28**	M	0.22	**: 5.6**
C	4.43	**: 113**	H	0.85	**: 21.6**	N	0.37	**: 9.4**
D	2.03	**: 51.6**	J	0.22	**: 5.6**	P	0.72	**: 18.3**
E	1.02	**: 25.9**	K	0.13	**: 3.3**	Q	1.04	**: 26.4**



Programmable Tags
(continued)

Figure 9.3
Mounting Dimensions, Flatpak Tag, Catalog No. 2750-TFAU40



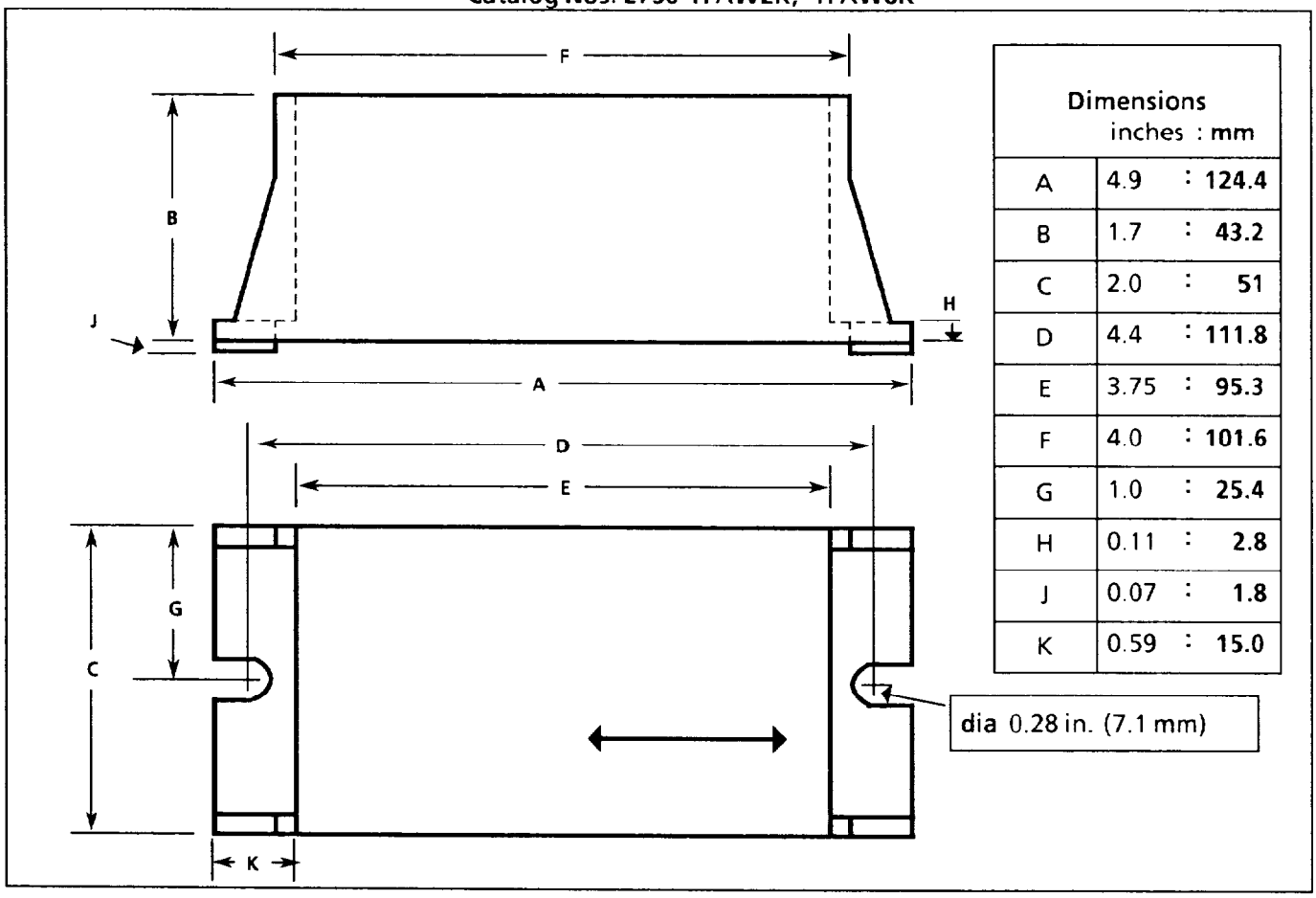
Dimensions inches : mm	
A	2.15 : **54.6**
B	3.7 : **93.9**
C	3.45 : **87.6**
D	1.9 : **48.2**
E	1.85 : **47.0**
F	0.12 : **3.1**
G	0.17 : **4.3**
H	0.18 : **4.6**
J	0.35 : **8.9**

Read Write Tags

For mounting read/write tags see Figure 9.4:

- Screw size: Up to 10/32
- Use of flat washers with screws is recommended.
- Torque to 20 inch/pounds maximum to avoid damage.

Figure 9.4
Mounting Dimensions, Read/WriteTags, Catalog Nos. 2750-TFAW2K, -TFAW8K



Dimensions inches : mm		
A	4.9	124.4
B	1.7	43.2
C	2.0	51
D	4.4	111.8
E	3.75	95.3
F	4.0	101.6
G	1.0	25.4
H	0.11	2.8
J	0.07	1.8
K	0.59	15.0

Tag Mounting

For best results, mount RF tags flush on a smooth metallic backplane surface.* Non-metal backplane may result in higher signal power setting requirement. Recommended backplane dimension is 8 in. × 8 in. (20 × 20 cm), although this is not mandatory.

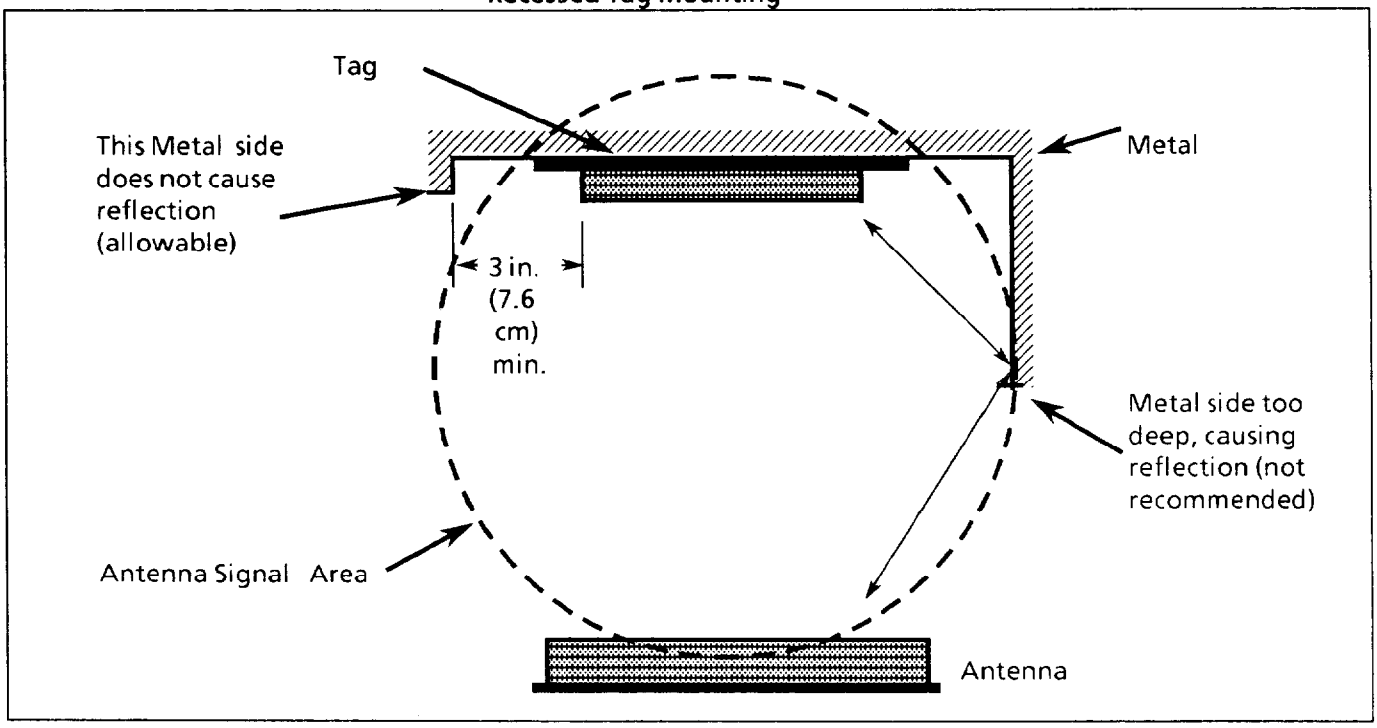
*Note: The Flatpak tag, Catalog No. 2750-TFAU40, is an exception to this. The Flatpak tag is designed for mounting to a non-metallic surface only.

Recessed Tag Mounting

If you plan to mount the RF tags within a recessed metal cavity, consult your Allen-Bradley representative for application specific guidelines to obtain the best results. General guidelines are (see Figure 9.5):

- Always allow a **minimum** of 3 inches (7.6 cm) spacing between sides of the tag and the cavity walls.
- If the cavity walls extend beyond the top of the tag, the spacing between the wall and tag should be great enough so the wall does not reflect the RF signals and interfere with antenna/tag transactions (consult Allen-Bradley for specific recommendations).

Figure 9.5
Recessed Tag Mounting



Tag Storage

Store tags which are not in use in an area far beyond the maximum antenna range, and in a direction which is behind the antenna face. See Chapter 3, Table 3.A and Figure 3.3 for tag turn-on distances (for read/write tags) and antenna ranges. We recommend storing tags in a metal enclosure when storing tags near the antenna signal or turn-on range.

Tag Disposal

The Allen-Bradley read/write tags, including Catalog No. 2750-TFAW2K and -TFAW8K, contain lithium batteries.

WARNING: Read/Write tags, Cat. Nos. 2750-TFAW2K and 2750-TFAW8K, contain lithium batteries. The lithium battery information provided here must be followed. If you fail to do so, equipment could be damaged and/or personnel could be injured.

Do not incinerate or dispose of lithium batteries in general trash collection. Explosion or rupture is possible.

Refer to Appendix B for disposal instructions.

Lithium can cause burns to skin. Do not pick up a ruptured tag with bare hands. Use tongs, a scoop, or a shovel.

Do not use water or carbon dioxide (CO_2) fire extinguishers on fires that contain lithium batteries. Lithium is reactive with these substances.

Appendix A Specifications

Antenna
(Cat. No. 2750-AH, -AHD, -AHP, -AHPR)

Electrical:

Input Power	Transformer (Catalog No. 2750-PA). 24 VAC (+20%, –25%) @ 2 Amps
Connectors	Two pressure plate type screws (8- and 5-terminal)
Fuse Type	3 Amp (Reg Blo) 125V Recommended: *Bussman AGX-3, Littlefuse 362003*
Object Detect Switch:	
Supply Source	10VDC to 30VDC at 50 ma. (Bul. 880L recommended)
Sink/Source Current	8-25ma.

Mechanical:

Enclosure:	
Rating	NEMA Type 4, 12, 13
Material	Main body: Die cast aluminum Remote head: Plastic
Dimensions, Main Body:	
Length	13.5 in. (34.3 cm)
Width	7.8 in. (19.6 cm)
Height	4.37 in. (11.1 cm)
Weight	14.0 lbs (6.4 kg)
Remote Antenna Head:	
Length	5.12 in. (13.0 cm)
Width	4.1 in. (10.5 cm)
Height	1.25 in. (3.2 cm)
Weight	0.75 lbs (0.34 kg)

Cable Requirements:

Remote head connector (for 2750-AHD, -AHPR only)	2 Coaxial Cables (Catalog No. 2750-C1)
Communication	BELDEN #9842, 4,000 feet (1200 meters)

Communications:

Serial format	DH-485
Protocol	IDP

Environmental:

Operating Temperature	0°C to +60°C
Storage Temperature	–40°C to +85°C
Relative Humidity	5 to 95%, noncondensing

Capabilities:

Power Levels	Catalog No. 2750-AH, -AHP, -AHPR: Programmable - 5 Steps (Minimum, Low, Medium, High & Maximum) Catalog No. 2750-AHD: Programmable - 2 Steps (Low, High)
Read / Write Data Transfer	6,144 bytes maximum transfer capability.
Intelligent Antenna Configuration	Software selected and stored in EEPROM.
Tag Types	Read / Write –2K, 8K bytes. Programmable – 6-digit, 20- character and 40-character.

Antenna (continued)

Approvals:	The 2750-AH, -AHD approved under FCC Regulations Part 15, Subpart F. FCC ID:
	FUN4TM2700, FUN4TM2750-D
	The 2750-AHP, -AHPR require an FCC approved site license for operation of the antenna in the United States.

Programmable Tag (Cat. No. 2750-TPC20, -TSHU40, -TAU40, -TFAU40)

Passive Programmable 6 digit, 20, or 40 Character Format Tags.
(For more information, see Pub. No. 2750-2.9, "Bulletin 2750 RF Tags")

Electrical:	
Input Power	EEPROM memory. No battery required.
Mechanical:	
Enclosure Material Rating	Plastic – Watertight and submersible. NEMA Type 4, 6P, 12, 13 (Catalog No. 2750-TAU40 and -TFAU40 are NEMA Type 4 only).
Approx. Dimensions	See pages 9-3, 9-4.
Approx. Weight	2.5 oz. (70 grams)
Mounting Orientation	With -AH, -AHP Antenna Pitch ± 0° Roll ± 25° Yaw 360°
	With -AHD, -AHPR Antenna Pitch ± 0° Roll ± 25° Yaw ± 25°
Environmental:	
Operating Temperature	0°C to +70°C
Storage Temperature	–40°C to +85°C
Maximum Operating Temperature	Excursion to 200° C for 30 min. non-operative, operations resume after the tag cools to 70° C (Catalog No. 2750-TSHU40 or -TPC20 only).
Data Retention	10 years below +70°C 300 hours @ +200°C
Capabilities:	
Operating Frequency	915 / 1830 MHz
Memory	40 bytes total: 6, 20, and 40 byte formats are available.

Programmable Tag (Cat. No. 2750-TPC20, -TSHU40, -TAU40, -TFAU40) (continued)

Read Distance	Variable by adjusting RF power level setting. Catalog No. 2750-AH and -AHP: 6" to 48" (15 to 122 cm) from antenna. Catalog No. 2750-AHPR: 6" to 60" (15 to 152 cm) from antenna. Catalog No. 2750-AHD: Low Power = 2-4 inches (5 to 10 cm) High power = 2-8 inches (5 to 20 cm)
Programming Distance	Catalog No. 2750-AHP: 5 to 7 inches (13 to 18 cm) Catalog No. 2750-AHPR: 5 to 9 inches (13 to 23 cm) **Note:** Catalog No. 2750-AH and -AHD cannot program programmable tags.
Tag Speed- Program Operation	Catalog No. 2750-AHP, -AHPR: Stationary
Read Operation	Catalog No. 2750-AH and -AHP: 880 ft. /min./40 characters at 4 feet. (268 m/min./40 characters at 1.2 m) Catalog No. 2750-AHPR: 1100 ft./min./40 characters at 5 feet (335 m/min./40 characters at 1.5 m) Catalog No. 2750-AHD: 15 feet/min./40 characters at 2 inches (4.8 m/min./40 characters at 5 cm) 20 feet/minute at 8 inches (6.1 m/min./40 characters at 20 cm)

Read/Write Tag (Cat. No. 2750-TFAW2K, -TFAW8K)

Industrial Read / Write Tags (2K or 8K Bytes)
(For more information, see Pub. No. 2750-2.9, "Bulletin 2750 RF Tags")

Electrical:	
Input Power	Battery powered device.
Mechanical:	
Enclosure:	
Rating	NEMA Type 4, 12
Dimensions:	See page 9-5.
Approx. Weight	5.5 oz. (154 grams)

Read/Write Tag (Cat. No. 2750-TFAW2K, -TFAW8K) (continued)

Mounting: Orientation	With -AHD, -AHPR Antenna: Pitch ± 0° Roll ± 25° Yaw ± 25° **Note:** Tag may be off axis in one direction only.
Environmental:	Clean with standard industrial solvent (not MEK, TOLUENE, FREON etc.)
Operating Temperature	0°C to +50°C
Storage Temperature	-40°C to +70°C
Tag Life	5 year battery shelf life (also depends on number of read / write cycles).
Capabilities:	
Operating Frequency	915 / 1830 MHz
Memory	2K or 8K bytes of RAM
Read or Write Distance	Catalog No. 2750-AH and -AHP: 6" to 24" (15 to 61 cm) from the antenna. Variable RF power level setting. Catalog No. 2750-AHPR: 6" to 48" (15 to 122 cm) from the antenna. Variable by adjusting RF power level setting. Catalog No. 2750-AHD: Low power = 2-4 inches (5 to 10 cm) High power = 2-8 inches (5 to 20 cm)
Tag Speed (Read or Write Operation)	Catalog No. 2750-AH: 300 ft./min./32 bytes at 2 ft. (91.4 m/min./32 bytes at 61 cm) Catalog No. 2750-AHP: 880 ft./min./32 bytes at 2 ft. (268 m/min./32 bytes at 61 cm) Catalog No. 2750-AHPR: 1760 ft./min./32 bytes at 4 ft. (536 m/min./32 bytes at 122 cm) Catalog No. 2750-AHD: 100 ft./min./32 bytes at 2 inches (30.5 m/min./32 bytes at 5 cm). 130 ft./min./32 bytes at 8 inches (39.6 m/min./32 bytes at 10 cm).

Power Supply
(Catalog No. 2750-PA)

Electrical:

Dual Primary	97–128 VAC, 47–63 Hz 195–253 VAC, 47–63 Hz
Secondary	24 VAC
Regulation	±10%
Load Current	10 Amp
Isolation	2500V primary to secondary
Overload Protection	Fused secondary
Input Connections	The 97–128 VAC input will be produced when H1 and H3 are connected together, and H2 and H4 are connected together. The line voltage is then applied to (H1, H3) and (H2, H4). The 195–253 VAC input will be formed when H2 and H3 are connected together and line voltage is applied to H1, H4.

Mechanical:

Approx. Dimensions	
Length	6.0 in. (15.2 cm.)
Width	4.5 in. (11.4 cm.)
Height	5.3 in. (13.3 cm.) Height includes the terminal block.

Environmental:

Operating Temperature	0°C to +60°C
Output (Secondary) Terminals	There are 4 sets of output connections for the 2750–PA, labeled X1 & X2.
Wire Size	14 gauge
Fuse Type	Littelfuse 3 AB "SloBlo" Catalog No.325010
Rating	10 Amps

Appendix B Considerations for Use in the United States

FCC Licensing Requirements

Operation of the Allen-Bradley 2750-AH series antennas in the United States falls under the regulation of the Federal Communications Commission (FCC).

FCC site licensing is necessary to operate the 2750-AHP and -AHPR serial antennas. Call your local Allen-Bradley representative for assistance in the procedure of applying for site licensing. The FCC approval or license requirement for each of the different serial antenna types is listed below:

Catalog No. 2750-AH – is FCC approved.* FCC site license is **not required** by the user to operate this device.

FCC ID: FUN4TM2700

*This device is approved under FCC Regulations Part 15, Subpart F.

Catalog No. 2750-AHD – is FCC approved.* FCC site license is **not required** to operate this device.

FCC ID: FUN4TM2750-D

*This device is approved under FCC Regulations Part 15, Subpart F.

Catalog No. 2750-AHPR – FCC approved site **license is required** for operation of the antenna.

Catalog No. 2750-AHP – FCC approved site **license is required** for operation of the antenna.

ANSI Safety Level Standards

Non-Ionizing Radiation

The user is referred to ANSI C95.1-1982, **Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 KHz to 100 GHz.** The ANSI C95.1-1982 standard does not consider products with 7 watts or less into the radiated element, at frequencies between 300 KHz and 1 GHz, to be a health hazard.

The Bulletin 2750-AH, AHP, AHPR and AHD outputs are within ANSI standard for safety levels with respect to human exposure to RF electromagnetic fields.

RF Tag Disposal

The Allen-Bradley read/write tags contain lithium batteries.

Tags with lithium batteries must be packaged and shipped, in accordance with transportation regulations, to a proper disposal site. The U.S. Department of Transportation authorizes shipment of "lithium batteries for disposal" by motor vehicle only in regulation 173.1015 of CFR49 (effective Jan. 5, 1983). For additional detailed information, contact:

U.S. Department of Transportation
Research and Special Programs Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

Although the United States Environmental Protection Agency at this time has no regulations specific to lithium batteries, the material contained in the battery may be considered toxic, reactive, or corrosive. The person disposing of the material is responsible for any hazard created in doing so. State and local regulations may exist regarding the disposal of these materials.

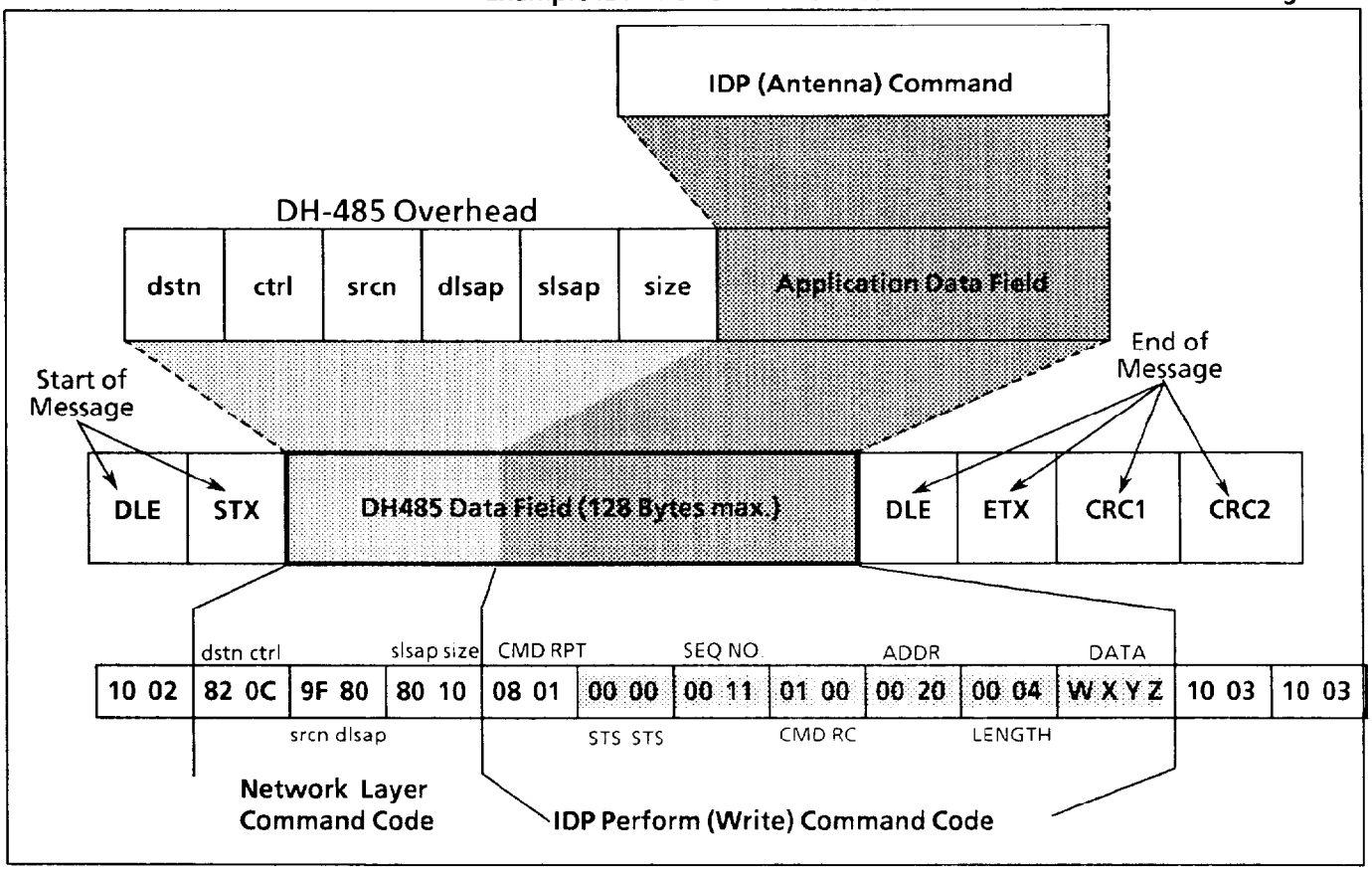
Appendix C DH-485 Communications Protocol

DH-485 Message Structure

In order to use the IDP commands, they must be contained in the DH-485 message format. Refer to Figure C.1. Most of the DH-485 communications protocol is handled by the Flexible Interface Module (Catalog No. 2760-RB). When sending commands to the antenna through the Flexible Interface Module, the host device will need to send the following data:

- Byte Count (PLCs Only)
- Source Port
- Destination Port
- Destination LSAP
- Source LSAP
- Destination Node #
- Source Node #
- Command Data

Figure C.1
Example IDP "Perform Write" Command as Part of DH-485 Message



DH-485 Message Structure (Continued)

The following are descriptions of each byte in a DH-485 message using IDP protocol. If you are using a Flexible Interface Module, many of the network functions are handled automatically (refer to Chapter 7).

DLE (Data Link Escape)- Precedes each message (10 hex). If you are using a antenna on a DH-485 network using the Flexible Interface Module, this byte is handled automatically.

STX (Start of Transmission)- Follows the DLE character to indicate the beginning of the message (02 hex).

dstn (Destination Node #)- Value from 0 to 31 which indicates the node number where the message is being sent.

ctrl (DH-485 Control Byte)- This byte contains the Send Response With Data control field. This byte has the following bit pattern:

X 0 0 0 1 1 0 0 *where X = toggle bit*

The master node that is polling the antenna for data changes the state of the toggle bit with each new message. If the master node had a problem receiving the antenna's response, the message is re-sent without changing the toggle bit. This allows the antenna to differentiate between new and repeated messages.

srcn (Source Node #)- Value from 0 to 31 which indicates the node number of the device sending the message. If you are using an antenna on a DH-485 network using the Flexible Interface Module, this byte is handled automatically.

dlsap (Destination Link Service Access Point)- This value 00 or 128 indicates the communications layer that the message is being sent to:

- LSAP 0- Send DH-485 network status bytes.
- LSAP 128- Send commands and receive responses.

slsap (Source Link Service Access Point)- This value 00 or 128 indicates the communications layer of the device sending the message:

- LSAP 0- Send DH-485 network status bytes.
- LSAP 128- Send commands and receive responses.

size- Value from 8 to 128 that indicates the size of the IDP command in bytes.

Communications Link Diagnostic Commands

You can obtain diagnostic data on the communications link (DH-485 Network) using the diagnostic commands:

- Diagnostic Loop (CMD = 06H, FNC = 00H)
- Read Diagnostic Counters (CMD = 06H, FNC = 01H)
- Read Diagnostic Status (CMD = 06H, FNC = 03H)
- Reset Diagnostic Counters (CMD = 06H, FNC = 07H)

Note: To obtain communications link diagnostics, the destination LSAP byte must be set to 00.

The communications link diagnostic commands have the following structure:

Link Diagnostic Command Format				
Word Offset	**Command Field**	**(Byte Offset)**	**Command Field**	**(Byte Offset)**
00	CMD = 06	(00)	STS = 00	(01)
01	**Transaction No. (MSB)** (00)	(02)	**Transaction No. (LSB)** (00)	(03)
02	FNC = (see below)	(04)		

Where function code of:

00 = Diagnostic Loop command.

01 = Read Diagnostic Counters command.

03 = Read Diagnostic Status command.

07 = Reset Diagnostic Counters command.

Read Diagnostic Status Reply The Read Status Bytes command returns the following data:

Read Diagnostic Status Reply Format				
Word Offset	Command Field	(Byte Offset)	Command Field	(Byte Offset)
00	Response (46)	(00)	Status (00)	(01)
01	Transaction No. (MSB) (00)	(02)	Transaction No. (LSB) (00)	(03)
02	Mode/Status (00)	(04)	Type Extender (EE)	(05)
03	Interface Type (2B)	(06)	Processor Type (2D)	(07)
04	Series/Revision (00)	(08)	2	(09)
05	7	(0A)	5	(0B)
06	0	(0C)	-	(0D)
07	A	(0E)	H	(0F)
08	00	(10)	00	(11)
09	00	(12)	00	(13)
0A	00	(14)	00	(15)
0B	00	(16)	00	(17)
0C	00	(18)	00	(19)
0D	00	(1A)	00	(1B)

Note: The response code is 46(hex). The status byte indicates:

00 = Success
10 = Invalid command or function

Read Diagnostic Counters Reply

The Read Diagnostic Counters command returns the following data:

Diagnostic Counters Reply Format				
Word Offset	Command Field	(Byte Offset)	Command Field	(Byte Offset)
00	Response (46)	(00)	Status (00)	(01)
01	Transaction No. (MSB)	(02)	Transaction No. (LSB)	(03)
02	Received Messages* (MSB)	(04)	Received Messages (LSB)	(05)
03	Transmitted Messages** (MSB)	(06)	Transmitted Messages (LSB)	(07)
04	00	(08)	00	(09)
05	00	(0A)	00	(0B)
06	Bad Messages Received***	(0C)	00	(0D)

* Number of IDP or link diagnostic commands received.
** Number of IDP or link diagnostic commands transmitted.
*** Messages too large or containing incorrect CRC

Note: The response code is 46(hex). The status byte indicates:

00 = Success
10 = Invalid command or function

Diagnostic Loop Reply

The diagnostic loop command echoes any data contained in the data area (following function code) of the command. Up to 123 bytes of data may be contained in the data area.

Diagnostic Loop Reply Format				
Word Offset	Command Field	(Byte Offset)	Command Field	(Byte Offset)
00	Response (46)	(00)	Status (00)	(01)
01	Transaction No. (MSB) (00)	(02)	Transaction No. (LSB) (00)	(03)
02	Data	(04)	Data	(05)

Note: The response code is 46(hex). The status byte indicates:

00 = Success
10 = Invalid command or function

Appendix D ASCII Table

ASCII or Control Char.	Decimal Value	Hex Value	ASCII or Control Char.	Decimal Value	Hex Value	ASCII or Control Char.	Decimal Value	Hex Value	ASCII or Control Char.	Decimal Value	Hex Value
NUL	0	0	[Space]	32	20	@	64	40	'	96	60
SOH	1	1	!	33	21	A	65	41	a	97	61
STX	2	2	"	34	22	B	66	42	b	98	62
ETX	3	3	#	35	23	C	67	43	c	99	63
EOT	4	4	$	36	24	D	68	44	d	100	64
ENQ	5	5	%	37	25	E	69	45	e	101	65
ACK	6	6	&	38	26	F	70	46	f	102	66
BEL	7	7	'	39	27	G	71	47	g	103	67
BS	8	8	(	40	28	H	72	48	h	104	68
HT	9	9	)	41	29	I	73	49	i	105	69
LF	10	A	*	42	2A	J	74	4A	j	106	6A
VT	11	B	+	43	2B	K	75	4B	k	107	6B
FF	12	C	,	44	2C	L	76	4C	l	108	6C
CR	13	D	-	45	2D	M	77	4D	m	109	6D
SO	14	E	.	46	2E	N	78	4E	n	110	6E
SI	15	F	/	47	2F	O	79	4F	o	111	6F
DLE	16	10	0	48	30	P	80	50	p	112	70
DC1	17	11	1	49	31	Q	81	51	q	113	71
DC2	18	12	2	50	32	R	82	52	r	114	72
DC3	19	13	3	51	33	S	83	53	s	115	73
DC4	20	14	4	52	34	T	84	54	t	116	74
NAK	21	15	5	53	35	U	85	55	u	117	75
SYN	22	16	6	54	36	V	86	56	v	118	76
ETB	23	17	7	55	37	W	87	57	w	119	77
CAN	24	18	8	56	38	X	88	58	x	120	78
EM	25	19	9	57	39	Y	89	59	y	121	79
SUB	26	1A	:	58	3A	Z	90	5A	z	122	7A
ESC	27	1B	;	59	3B	[	91	5B	{	123	7B
FS	28	1C	<	60	3C	\	92	5C	|	124	7C
GS	29	1D	=	61	3D	]	93	5D	}	125	7D
RS	30	1E	>	62	3E	^	94	5E	~	126	7E
US	31	1F	?	63	3F	_	95	5F			

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